UNIVERSITY OF MARYLAND
AGRICULTURAL EXPERIMENT STATION

RESEARCH:

GATEWAY TO AGRICULTURAL PROGRESS

SEVENTY-FIRST ANNUAL REPORT
BULLETIN A-105 JUNE 1959

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SEVENTY-FIRST ANNUAL REPORT, 1957-1958

VERSITY OF MARYLAND
CULTURAL EXPERIMENT STATION

BULLETIN A-105
COLLEGE PARK
MARYLAND
JUNE 1959

University of Maryland
Agricultural Experiment Station

To The Governor of Maryland,
the Board of Regents,
and the President of the University of Maryland

I transmit herewith the Seventy-First Annual Report of the University of Maryland Agricultural Experiment Station, as established by Act of Congress, March 2, 1887, containing an account of research and experiments conducted during the fiscal year ending June 30, 1958, and a statement of the receipts and disbursements for the same period.

I. C. Haut
Director

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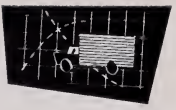
AGRICULTURAL ECONOMICS



Economic research provides current information involved in making decisions to effect adjustments in agriculture. Improved marketing practices and econical farm production are directed toward the most efficient utilization of resources in order to assure the maximum return to agriculture.

How to Adjust Farm Organization and Operation

Rapid changes in technologies and farm practices continually raise new problems regarding the most profitable organization of farms. Most new practices or technologies which are adopted on individual farms result in larger capital investments. This generally is true whether the change is relatively simple such as adoption of a new variety or whether it is more complex such as replacement of hand labor with mechanized methods. To spread this larger capital investment over a greater number of units, total output is increased. However, as total farm production is expanded gross income may not be increased because of falling prices. Declines in prices of farm products frequently are proportionately greater than increases in output. When these conditions occur, some resources must be shifted to other uses if reductions in net farm incomes are to be avoided. The speed at which change in resource use occurs depends on resource owners' knowledge of available income alternatives.

Information developed in this study will form bases for evaluating the kinds of adjustments which are most likely to prove profitable on individual farms. As available resources, sizes of farms, and market outlets vary, the type of needed adjustment as well as possible alternatives vary. Adjustments now occurring in Maryland agriculture range from relatively small changes in practices within one enterprise to more drastic changes in the number and sizes of enterprises. The type of adjustment and the speed at which it is made exert important influences on net farm incomes.

(Project A-18-am)

Survey Organization and Operation of Dairy Farms

A survey of 203 Maryland dairy farmers was conducted in 1957 to determine cropping system patterns and practices, to determine livestock production and feeding systems and to determine amounts and kinds of inputs used to obtain outputs of crops, livestock and livestock products. Data from this study will be used to budget different crop and livestock production alternatives on Maryland dairy farms. The alternative adjustments in farm organization and operation will be evaluated on the basis of the effect on net farm income.

The number of cows per farm varied from 10 to 189 cows and averaged 37 per farm. The effect of size of herd on the physical and economic efficiency of dairy farms will be analyzed. It is anticipated that information provided by this study will be useful to farmers in making decisions about adjustments in farm organization and operation whereby net farm income may be increased.

(Project A-18-al)

What Are The Sources of Highway Revenues?

About 87 percent of revenues used in providing highway facilities in Maryland in 1956 came from Maryland taxpayers. The other 13 percent was contributed through out-of-state vehicle use.

Passenger car use accounted for about two-thirds of State highway-user taxes. Such vehicle use was the basis for 91 percent of titling tax collections, three-fourths of bridge tolls, and nearly two-thirds of motor vehicle license revenues and fuel taxes.

Traffic is usually heaviest on interstate, or major state, highways, on which the larger proportion of out-of-state vehicles travel. Thus, highway-user tax earnings per mile are relatively greater on those roads.

Maryland vehicle use of highways generally involves the highway system as a whole. Local access roads and streets become feeders to secondary state highways, which in turn may be used primarily by Maryland vehicles.

A large percent of farmers and other rural residents are too far from an interstate, or major state, highway to make direct and constant use of same. Their user-tax contributions toward those highways may, therefore, be relatively greater than their direct use of such on an individual basis. Yet, on a group basis, the tax earning from local road use by rural residents may not be enough to finance local roads.

Federal and State aid allocations for local road improvement and maintenance help to adjust for this seeming imbalance between tax contributions and road use, and this aid may be justified partially on such grounds.

(Project A-19-r)

Maryland Tax System Appraised

State and local taxes in Maryland are rather proportional in the aggregate, with some regressive types of taxes. Several of these levies constitute fixed costs for farmers while prices of farm products have decreased in recent years, thereby making it more difficult for farmers to shift taxes imposed upon their businesses.

Maryland utilizes most of the major tax sources. The tax system is of sufficient scope to apply most of the principles of taxation. Based on several criteria, there appears to be sufficient tax resources within the State to meet the functional needs. However, State revenue yields in recent years have not kept pace with the trend in functional requirements.

Tax potentials in Maryland are materially reduced by various exemptions. These exemptions are partially responsible for tax rate increases. They also create problems of tax inequalities in many instances.

There is need for reappraising the use of property assessed values as the basis for local tax potentials and State aid equalization programs. A more equitable distribution of tax payments for support of State and local governments may be possible by the use of economic indexes other than, or in addition to, property ownership.

(Project A-19-s)

Membership in Farmer Cooperatives Growing

The number of cooperative associations in Maryland has remained relatively steady in recent years, but memberships increased. A large percentage of the total business volume was accounted for by a few large associations. The 45 purchasing, 20 marketing, and 19 service cooperatives operating in Maryland had a total business volume in excess of $105 million. The total

business was divided among the three major groups of cooperatives as follows: Marketing, $65.9 million or 62.8 percent; purchasing, $34 million or 32.8 percent; and service, including REA cooperatives, $5.2 million or 4.9 percent. Milk and milk products were the most important item handled cooperatively in Maryland, accounting for over 50 percent of the total cooperative business volume. The total membership in all cooperatives in Maryland was estimated at approximately 85,400.

The majority of the Maryland cooperatives appeared to be in sound financial condition. Two-thirds reported a net worth of over 50 percent and 65 percent had a better than 2 to 1 current asset to current liability ratio.

An analysis of several large marketing cooperatives which discontinued operating indicated that the lack of proper planning and foresight was perhaps the most prominent deficiency in marketing cooperatives which failed in recent years.

The major problems confronting farmer cooperatives in Maryland included maintaining sufficient volume for economic operation, lack of sufficient knowledge of cooperative business principles by management and members, and improvement of membership relations programs.

(Project A-26-al)

Livestock Slaughter Plant Operations Studied

A survey of 43 slaughter plants in the Maryland and Delaware area provides information on the source and distribution of animals slaughtered. The plants ranged in storage capacity from one beef carcass in the smallest plant to 600 carcasses in the largest. Chilling space ranged from 40 square feet in the smallest to almost 6,000 square feet in the largest. Plants obtained 30 percent of their livestock from auction markets, 35 percent from terminal markets, 10 percent from dealers, and 18 percent direct from farmers. Buyers tended to buy cattle and calves more frequently from auction markets. Direct purchases from farmers provided most of the hogs slaughtered.

Preferred weights for slaughter animals ranged widely, but in general buyers preferred beef steers and heifers weighing 800 to 1,000 pounds, cows weighing 900 to 1,000 pounds, bulls weighing more than 1,200 pounds, and calves weighing less than 150 pounds. There was no predominant weight and grade preference given for barrows and gilts. Lambs weighing 80 to 90 pounds were frequently preferred.

Three-fourths of the red meat production of these plants was beef, 17 percent pork, 7 percent veal, and 1 percent mutton and lamb. Output of the various plants was closely related to size of plant, and whether or not the plant was a Federally-inspected, wholesale, or local operation.

The distribution of meat was 58 percent to retailers, 23 percent to wholesalers, 12.5 percent to consumers direct, and 7 percent to institutions. Distribution in carcass (including halves and quarters) was predominant for beef, veal, mutton, and lamb. Pork was distributed largely in wholesale cuts. Distribution in consumer cuts was more important for beef than other kinds of meat.

(Project A-26-an)

Cost of Preparing Poultry Compared

The cost of preparing poultry for retail distribution is lower when done in the processing plant than in retail stores. At present, however, the bulk of fresh poultry is cut and packaged by the retailer. In order to make a fair

comparison between the cost of preparing poultry for display, four retail stores and three processing plants in the Maryland area were chosen for study. The cost of labor required to cut-up and package poultry at the retail store averaged 3.3 cents and at the processing plant, 1.7 cents per bird. Material used in packaging cost an additional 1½ to 2 cents per package and was the same for stores and plants. Preparing poultry in retail stores includes cutting, traying, wrapping, and weighing. On a per package basis, it costs 1 cent for cutting, 1 cent for traying, ½ cent for weighing and ¾ cent for wrapping.

Most of the cutting and packaging of poultry in stores took place between the hours of 9:00 and 11:00 a.m. and 1:00 and 3:00 p.m. Sales were found to be heaviest on weekends, but weekend purchases were not as pronounced as shown by studies made in 1951.

In the future, pre-packaged poultry may be delivered direct to retail stores, ready to be picked up by the customer. This will result in lower costs and presumably a lower mark-up to the consumer. Before poultry can be delivered in this manner, however, further improvements are needed to increase the shelf-life of the pre-packaged poultry. There is also need for greater flexibility in supplying stores with the proper quantities demanded.

(Project A-26-am)

Study Sweet Potato and Handling Practices

About 89 percent of the sweet potato acreage in Maryland is located in Worcester, Wicomico, and Anne Arundel Counties. Growers in Wicomico and Worcester Counties market sweet potatoes principally to local buyers, and in Anne Arundel County producers sell direct to handlers in Baltimore and Washington, D. C. Ultimately, the bulk of the sweet potato crop is shipped to markets in the States of New York, Maryland, Pennsylvania, Connecticut, Ohio, and New Jersey. Local canneries provide an important outlet for the No. 2 grade.

Producer-shippers depend almost exclusively on selling by consignment, but make some effort to sell direct to chain and other retail outlets. Those who sell direct to retailers are primarily buyer-shippers.

Based on available price and yield data, sweet potatoes that are allowed to mature longer will yield a higher volume of No. 1 Grade and result in a higher gross income per acre to the grower.

Less bruising will result in transit if baskets are neither over-filled nor under-filled. Where the baskets are filled and ceiled properly, a firm pack with fewer bruises in hauling results. Further improvements could be made in grading, curing, and storing practices. It may be advisable to consider storing a larger portion of the sweet potato crop to promote more orderly marketing during the year. About 80 percent of the crop was sold during the months of September, October, and November when prices were the lowest seasonally.

(Project A-26-au)

Good Tobacco Preparation and Grading Help Prices

Investigations on the preparation and marketing of Maryland tobacco under this project have shown that producers, Federal graders, and industry buyers all have considerable difficulty in uniformly sorting, grading and buying baskets of Maryland tobacco sold on the loose-leaf auction floors of the state.

The principal difficulty encountered by farmers is associated with the wide differences which exist from one crop to another, or even on different fields

on the same crop in the appearance of tobacco leaf after it has been cured and is ready for sorting into grades.

An experiment with the 1956 crop clearly demonstrated the fact that this crop could be increased in value by having Federal graders re-sort baskets picked from the auction floors at random into more carefully segregated groups of hands. Based on average prices paid by Federal grades this experiment resulted in increasing the value of tobacco taken from the floor in a sample which exceeded 5,000 pounds by approximately 5 cents per pound. This indicated that the original sorting had resulted in mixed baskets which contained more tobacco in excess of the Federal grade placed on the basket than there was in lower grades than that placed on the basket.

A duplication of the same study on some 3,000 pounds of the 1957 crop did not result in the same conclusion. Due primarily to a much lower quality crop, the Federal grades placed on baskets picked at random from the auction floor were quite evidently as good as the quality of tobacco on the baskets would merit. Re-sorts of this tobacco reduced the quality in terms of Federal grade and also in terms of bid prices.

Other experiments have indicated that the mixed condition of hands of tobacco on baskets result in considerable difficulty on the part of graders to duplicate the original grade if the same basket is placed on the floor another day. It was equally evident also, that in terms of prices bid by industrial buyers the same kind of difficulties were experienced.

(Project A-26-ay)

AGRICULTURAL EDUCATION

Research in Agricultural Education deals primarily with educational activities in rural areas. The two projects reported below deal with more effective ways of making farms a safer place to work and live, and improving the educational phases of community shows and exhibits. The first of these studies is designed to discover the effect of educational campaigns in reducing the high rate of accidents now prevalent on farms and to develop techniques for operating campaigns. The results show that such campaigns are very effective. This is the second year of the study. The second study is being conducted to discover ways local community shows, which are held all over the State, can be made more educational and more efficient.

Study Effectiveness of Safety Educational Campaigns

Accidents to farm residents takes a tragic annual toll in the United States of 14,000 lives and 1,200,000 injuries, many of these injuries resulting in permanent disability. In addition, there are economic losses totaling millions of dollars every year in property damage, medical costs and loss of productive man hours.

In recent years, the accident rate in industry has been cut in half, but accident prevention in rural areas has not kept pace.

Believing that farm accidents can best be prevented through education, the Agricultural Education Department is continuing for the second year a study to identify the causes of accidents on Maryland farms and to develop teaching techniques that will reduce hazards, make rural people more safety conscious and lower the farm accident rate.

The method of study used was to carry on extensive safety educational campaigns in selected communities and measure the accident rate during the following year against other communities in which no campaigns were conducted. Selected vocational agriculture teachers and vo-ag students have cooperated in making the safety study. Nine teachers conducted community safety educational campaigns through their vo-ag students and kept records and reported them. Three of these cooperated both years of the study. To measure the effectiveness of the educational campaigns, fourteen other teachers kept only accident records in their communities and reported them. None of the latter teachers kept records for more than one year.

The reported accidents in the two groups of communities are shown in the table below. It seems evident from this data that the accidents were reduced where campaigns were conducted.

In the communities where campaigns were conducted, the accident ratio was one for about every 62 farms, whereas in the communities where no campaigns were conducted the ratio was one for every 8.4 farms. The ratio of deaths was one to 680 farms and one for 176 farms, respectively, and the ratio of injuries was one for every 76.7 farms and one for every 21 farms, respectively. Likewise, in days lost by injuries there was a wide variation, with less than one-fourth of a day lost per farm in communities where the campaigns were conducted, as compared with almost two-thirds of day lost in the other communities. This, of course, does not include the time lost for those who were killed.

In the communities where the educational campaigns were conducted, the medical expense was $5.74 per farm while in the other communities it was $6.01 per farm. However, the bulk of the medical expense in the first group was the result of one severe tractor accident which cost one man $3,600.60. In property damage the ratio of loss per farm was only $4.24 for the communities where the safety educational campaigns were conducted as compared with $15.37 per farm in the other com-

Farm Accidents in Communities where Educational Safety Campaigns Were Conducted as Compared With Communities Having No Campaigns.

Item	*Communities Having Campaigns*	*Communities Having No Campaigns*
Number of farms in study	680	589
Number of vo-ag departments	9*	14
Number of accidents	11	70
Number of people killed	1	3
Number of people injured	9	28
Days work lost	143	374.5
Medical expense	$3,902.60	$3,477.00
Property damage	$2,880.00	$9,053.50

* Three of the vo-ag departments conducted safety campaigns for two years.

munities.

With most of the study completed, it is evident that safety education does prevent accidents. To find out which practices and techniques have been most successful in the safety campaigns conducted, a questionnaire has been prepared and circulated among the vo-ag teachers concerned. When the results have been accumulated, a proposed method of conducting such safety campaigns will be formulated and recommended. It is hoped that the procedure will be adaptable to a variety of rural groups desiring to conduct safety campaigns. *(Project T-4)*

Improving Agricultural Community Shows and Exhibits

Community shows and exhibits have been conducted in a large number of communities in Maryland for many years. These shows are generally under the sponsorship of high school chapters of the Future Farmers of America, high school departments of Home Economics, local 4-H clubs, local Granges and other local organizations, or cooperatively by two or more of these groups. Much public money and effort has been, and is being, expended to operate them.

The objectives of the study are (1) to determine the present nature, sponsorship and extent of these shows in the State, (2) to determine their educational value, (3) to discover difficulties and possible remedies, and (4) to suggest ways they can be improved.

The initial part of this project has been the development of forms and techniques for gathering the information needed. A number of the shows have been visited and an informal survey made. In the coming year, information will be obtained on all of the shows possible.

The Maryland State Fair Board has shown a keen interest in this project and is actively cooperating. Other cooperating agencies are the State Department of Education, the University of Maryland Extension Service and local groups sponsoring the shows.

(Project T-5)

AGRICULTURAL ENGINEERING

The application of electricity to agriculture is one of the broad fields of agricultural engineering research. As a source of power it is economical, versatile and easy to control automatically, even from remote points. It therefore plays a large part in mechanizing farmstead and household work and is now becoming an important factor in field work.

Ease of precise control, lack of exhaust gases and ease of application at a remote point make electricity an important source of heat for such varied applications as brooding chicks, heating water, treating of seeds and plants for disease and insect control, hot bed heating, etc.

Lights and other forms of electrically produced radiation not only provide for better sight but are used in the control of plant growth, the treatment of animals and plants, sorting and grading of produce and in the automatic control of many processes.

Continue Tests on Tobacco Curing and Handling

Test were continued on determining the optimum conditions for curing Maryland type 32 tobacco.

The constant atmospheric conditions maintained during curing studies this season were a dry-bulb temperature of 70°F with constant relative humidities of 90, 80, 70 and 60 percent for the different treatments. A check was maintained at 80°F and 80% relative humidity for better comparison of previous years' work.

A complete evaluation of the results has not been completed. However, indications are that the best cure for the 70°F temperature occurred at 80% relative humidity. However, as true with previous years' tests, the check condition of 80°F and 80% RH produced the best cure.

There was a noted decrease in value and quality of the tobacco cured at the 90% relative humidity condition due to severe "houseburn." The lower humidities produced an excessive number of "M" (mixed color) government grades due to the heavier light colored tobacco.

When comparing the previous years cure at 80°F and 90% RH with the 70°F and 90% RH, it was found that there was drop in value for the 70°F condition. The 80°F condition gave a value of $60.17 per 100 pounds while the 70°F condition gave a value of $40.26 per 100 pounds. The yield in pounds per acre for the 80°F temperature was quite low with a great deal of loss due to crumbling caused by "houseburn." While there was severe "houseburn" at the 70°F temperature it seemed the main effect was darkening of the leaf with the yield in pounds per acre being about average. There was little crumbling and loss during handling as was experienced during the previous year.

(Project R-11)

Attempt to Develop System for Handling Chopped Hay With Air

This year's work was a combination of previous work on methods of obtaining a uniform flow of material into the air stream. The forage blower used to introduce the partially cured chopped hay into the air stream was rebuilt. The boot of the blower was altered so that it would accommodate the discharge from the blower as well as the fan and so located that it offset a tangential line from the blower where the material became free to leave the blower blade. The discharge from the fan was reduced in the boot to increase the velocity and reduce the static pressure in an effort to decrease back pressure on the blower. These changes improved the performance of the equipment. However, additional work will be required to determine the proper relationship of size and location of the discharges from the fan and blower.

In an effort to have as uniform feed of hay as possible, we used a commercial forage box equipped with a cross feed. This discharged into a conveyor that we equipped with a leveling device set at 45° to the conveyor so that it would remove the material above a predetermined depth in the conveyor rather than kick it back onto the oncoming material. This improved the uniformity of feed. However, at times large clumps of hay were discharged into the system, causing clogging.

A high speed conveyor was tried in place of the blower to introduce hay into the air stream. The hay was fed between two belts whose surfaces run in the same direction. The lower belt was run by a 3 H.P. electric motor and the top one by a 2 H.P. electric motor. Air was supplied by a volume fan driven by a gasoline engine. This equip-

ment was promising. However, some modifications will be required to obtain satisfactory performance.

(Project R-16)

Study Sweet Potato Harvesting

The problem of removing vines from sweet potatoes is still the big hurdle in mechanical harvesting. Equipment built in 1956 was again tested this time in a field with large stones. Vines directly over the row were again not completely eliminated and the rotor with the long tines was found to be quite vulnerable to stone damage.

New equipment was built and tested consisting of two units mounted on one frame. The forward unit was a rotor system similar to that used on the 1956 machine but narrower to reduce the power requirement and with tines 2″ long to reduce the danger of stone damage and to help further reduce the power required. This unit was mounted directly over the row and set at an angle to the direction of travel so as to remove the vines which were parallel to the row. This unit was quite effective in removing all growth in a band directly over the row. This material was quite well shredded.

A second unit mounted aft consisted of two small mechanisms similar to a roller-bar hay rake which moved the remaining vines toward the space between the rows. This system was quite satisfactory for digging alternate rows but the loose vines from these rows made vine removal on the remaining rows almost impossible.

(Project R-18)

AGRONOMY

Research in the Department of Agronomy is necessarily of a highly diverse nature. The several field crops of importance in Maryland, grown on the variable types of soils in the State, present a wide variety of problems in production. Answers to these problems and the development of new and improved practices needed to keep pace with a rapidly changing agriculture are the products of research.

Emphasis in all the work of the Department is given to ways and means of providing insurance to crop production and lowering production costs or otherwise increasing efficiency in farming. To most effectively carry out these objectives every attempt is made to maintain an effective balance of basic and applied research.

Forage crops, of which there are several species and strains of importance in this State, are fundamental to a profitable and sustained livestock enterprise. In recognition of this, a new forage research farm was obtained this year to permit strengthening of programs in this area. Investigations at this farm will be conducted jointly between the Department of Agronomy and the Department of Dairy Husbandry.

Tobacco is the crop around which the agricultural economy of Southern Maryland is built. Soybean acreage has increased sharply since 1952 on the Eastern Shore. Corn and small grains continue to contribute significantly as concentrate feeds for livestock.

Research in all these crops continues in an effort to develop improved varieties and to perfect methods of culture and production or devise new and better ones. Answers to the soil fertility and management problems that arise in the production of the several crops continue to be sought out in the soils research program.

Only the highlights of some of the recent results are presented in the brief reports that follow. Detailed information is made available from time to time in scientific journal articles and in Experiment Station and Extension publications of various types. Field days and other programs and meetings where farmers are always most welcome and encouraged to attend are another means by which results of research are passed on to farmers.

Excellent cooperation with other departments in the Agricultural Experiment Station, as well as various units of the Agricultural Research Service of the United States Department of Agriculture, has contributed immeasurably to the success of the research program.

Hybridization and Testing Program Produces Improved Soybeans

This project, conducted cooperatively with the Forage and Range Research Branch of ARS at Beltsville, Maryland, includes a hybridization program and subsequent testing of selected segregates, variety testing, and cultural studies.

An adequate hybridization and testing program insures a continuous supply of new, improved varieties of soybeans superior to existing varieties in such characteristics as seed yield, seed quality, disease resistance, oil and protein content of seed, and resistance to shattering and lodging. Data collected to date indicate that several new strains are superior, and plans for their increase and release are in progress.

(Project B-43)

Soybean Cultural Practices Studied

Variety and date of planting studies conducted in Maryland since 1952 indicate considerable seasonal variation in performance of varieties at different dates of planting. In general, however, production has decreased when plantings have been made subsequent to June 20. Later maturing varieties (Group V and VI) have been more consistent producers at latest planting dates, as compared to earlier varieties (Group IV).

Rate of seeding studies indicate small differences in yield of seed at widely varying rates of seeding. Simulated lodging studies indicate that the effect of lodging is not consistent for time of lodging, variety, or season. Lodging may or may not decrease seed yields of soybeans; thus it would seem desirable to continue selection for lodging resistance in the breeding program.

(Project B-43)

A New Corn Hybrid Released for Maryland Use

This project provides local data for most of the hybrids that currently appear to have a place in Maryland. In 1957, replicated, hand-planted evaluation tests were conducted as follows: a 60-entry, early-planted test and a 30-entry, late-planted test near College Park, a 40-entry test in Talbot County, and a 15-entry test in Kent County. In the search for better parental lines for making superior hybrids, 85 experimental inbred lines were studied in the nursery. In addition, a collection of the most stalk-rot resistant inbred lines obtainable was collected and compared for natural infection.

Based on its 3-year performance in Maryland tests, as well as its perfor-

mance in other northeastern states, a new hybrid, NE912, has been named by the Northeastern Corn Improvement Conference. NE912 has the pedigree, (C103xCI.7) (Oh.07xCI.21E). At College Park it has been slightly later than U.S. 505 and Conn. 845 and has shown a 4-bushel yield advantage over these hybrids. Stalk and root strength have been equally good. NE912 promises to be a valuable addition to the list of hybrids suitable for Central and Eastern Maryland.

(Project B-50)

Chesapeake Red Clover Released to Farmers

A new red clover named Chesapeake was released by the Maryland Agricultural Experiment Station in January, 1958. Because of its consistently high yields, improved persistence, and some resistance to southern anthracnose disease, Chesapeake is expected to quickly find an important place on Maryland farms.

A program of maternal line selection in red clover has been conducted at the Maryland Agricultural Experiment Station since 1948. Special emphasis has been given to resistance to southern anthracnose, *Colletotrichum trifollii,* and to increased longevity. Progeny tests and synthetic varieties of lines originating from several cycles of maternal line selection were established in 1957 and will be evaluated in 1958 and subsequent years. The amount of genetic progress made by maternal line selection will be evaluated.

(Project B-56-a)

Search for New Ladino Clover Continues

A persistent, productive variety of Ladino clover is needed as a component of taller growing, grass-legume combinations used for semi-permanent pastures throughout the Northeastern Region. Identification, maintenance, increase, and testing of breeding materials of this species are conducted on a Regional basis.

Clones selected for resistance to *Sclerotinia trifoliorum,* longevity, and productivity are being evaluated by a polycross progeny test, established at College Park in 1957. Other phases include a variety and synthetics test and the production of polycrosses among selected, parental clones.

(Project B-56-g)

New Orchardgrass Synthetics To Be Evaluated

A three-year evaluation of parental clones, their polycross progenies, and synthetic varieties was concluded in 1957. New synthetics will be made and tested on the basis of these tests. Most promising material seems to be among the medium and late-maturing orchardgrasses. Evaluation of 3000 clones in a source nursery failed to reveal material superior to certain clones concurrently tested in the NE-28 Regional Orchardgrass Tests.

(Project B-56-i)

New Pasture Combination Increases Beef Production

Good pastures are the most economical source of livestock feed and for this reason considerable effort is being placed on pasture improvement. During the 1957 growing season the Midland Bermudagrass-rye combination looked extremely good. This combination produced 709 pounds of beef per acre which was over 250 pounds more than orchardgrass-Ladino, the next highest producing pasture. This combination furnished 39 more days of grazing than orchardgrass and reed canarygrass and 57 more days than Ken-

Yearling Hereford steers grazing new hybrid Bermudagrass in experimental pastures. This new grass remains productive during hot, dry weather.

Rye was seeded in heavy Bermudagrass sod to furnish late fall and early spring grazing. Crimson clover on either side.

tucky bluegrass. The Bermudagrass-rye pasture system makes possible the extension of the grazing season both in the spring and the fall as well as increasing forage production during the hot, dry summer months when most other pastures are unproductive.

(Project B-56-j)

Forage Variety Testing Reveals Best Varieties

Adequate and continuous testing of varieties of forage crops is always necessary in the search for new, improved varieties of forages. Highly selected material from various parts of the country must be evaluated in addition to that of our own Experiment Station. Evaluation of all material requires a number of seasons. Variety tests of different forage species were continued at College Park, Trappe, Kent County Experimental Farm, and selected, cooperating private farms throughout the State.

As a result of this testing program, the superiority for Maryland conditions of strains of a number of forages has been established and others look highly promising. Williamsburg and Narragansett have contributed to the increase of alfalfa acreage in Maryland during recent years. Socheville and DuPuits alfalfa have been highly productive at College Park for each of four successive years. Chesapeake red clover, released by the Maryland Agricultural Experiment Station in early 1958, is an improved variety in regard to forage yield and stand persistence. Pilgrim has been the most consistent producer of all Ladino clovers. Alta and Kentucky 31 fescues have been quite similar in performance. Potomac and commercial orchardgrass have been the most productive strains of their species. Preliminary evaluation of Bermudagrass strains indicates superiority of Midland and Greenfield for forage yield and winter survival.

(Project B-56-l)

Better Forage Stands Result from Good Seedling Management

The establishment of new forage stands is expensive. Unless planting is done correctly and young stands managed properly, seedings may be unsatisfactory or fail entirely. Band seeding is the best insurance against initial stand failure, and vigorous plants resulting from band seeding usually produce good forage stands. However, much better stands are obtained and higher yields produced if proper seedling management is followed.

Tests were conducted during the 1957 growing season in which alfalfa-bromegrass and Ladino clover-orchardgrass seedings were grown in plots where weeds were removed by hand throughout the season and where they were left to compete with the seeded forage species. One plot of each was left unclipped while the other was clipped three times. The hand removal of weeds doubled the crown weights of both alfalfa and bromegrass as well as the stolon length of Ladino clover. Frequent clipping reduced the vigor of alfalfa, bromegrass and orchardgrass, while it stimulated the development of Ladino clover. This stimulation of Ladino clover appeared to be more a result of reduced competition from weeds or associated forage species than increased or stimulated growth due to the frequent clipping itself. Ladino clover stolon length per plant in plots with weeds where no clipping was made was 1.68 inches as compared to 15.08 inches where weeds were removed and three clippings made. Simply by removal of weeds stolon length per plant was increased to 12.70 inches.

(Project B-56-m)

Nitrogen Fertilized Grass Highly Productive

When good mixtures of legumes and grasses can be easily maintained, forage production is usually good. In situations where legumes cannot be easily maintained, it may be more economical to seed straight grass to be fertilized with nitrogen.

In a test in Southern Maryland, six grasses grown alone and with a legume each under three nitrogen levels were harvested for the third year. Total weed-free forage yields during 1957 ranged from 2.21 tons per acre for Kentucky bluegrass-white clover plus 50 pounds of nitrogen to 8.42 tons per acre with Midland Bermudagrass, plus 300 pounds of nitrogen per acre. In general, where 50 pounds of nitrogen had been added to a grass-legume combination during the past three years, total forage production for the third year was less than where no nitrogen had been applied to this combination. Results during these three years demonstrate that on many light, sandy Coastal Plain soils it may be easier and more economical to seed pure grass stands and fertilize with commercial nitrogen than attempting to maintain a legume-grass mixture. The results also demonstrated that pastures in which the legume had been lost could be made productive by the application of commercial nitrogen.

(Project B-56-o)

Several Factors Influence Movement of CIPC In Soil

Because CIPC must enter the plant through its roots, it is important to know what factors of the soil influence movement of the chemical. It has been found that several soil factors had an important effect on the movement of the herbicide through the soil. In general, CIPC was found deeper in moist than in dry soils. In clay soil the chemical moved to deeper depths than in a sandy loam. The acidity of the soil also affected the movement of CIPC as it was found deeper in a soil with a pH of 4.2 than in a soil with a pH of 7.1. Organic matter is also apparently quite important in its effect on the movement of CIPC as soils with a higher organic matter content did not permit as much movement.

(Project B-58-d)

How Does CIPC Kill Weeds?

Basic studies on the action of the herbicide CIPC were continued in an effort to gain a better understanding of how the chemical kills weeds. Previously it was found that CIPC increased available carbohydrates in plants, and this was thought to be due to increased phosphatase activity. In studying the phosphatase activity of plants, it was found that the herbicide caused an increase in the activity of this enzyme in corn roots and shoots. It was also found to increase phosphatase activity in the roots of alfalfa, barley and wheat. However, it did not increase phosphatase activity of soybean roots. Thus, it might seem possible that the selectivity of this chemical is due to the fact that it has less influence on the phosphatase activity of some dicots than it does on monocots.

Studies on the respiratory quotient of corn root tips indicated that the increased phosphatase activity may have prevented the utilization of extra sugars in the plant.

(Project B-58-d)

Mixture of Chemicals Looks Good for Weed Control in Corn

Of the many chemicals tested for pre-emergence weed control of corn, EPTC, Randox, Emid, Diuron, Dinitro and Simazin were found to give very excellent early weed control.

Generally, the weed control tapered

off during the season. However, EPTC, Diuron and Simazin still exhibited good grass weed control three months after treatment. Simazin in particular gave excellent results.

Mixtures of Randox and several chemicals for broadleaved weed control almost invariably resulted in excellent weed control through most of the growing season. A mixture of Randox for grass control and 2,4-D for broadleaved weed control appeared promising.

(Project B-58-e)

Silvex Looks Best For Chickweed Control In Lawns

Chickweed, a winter annual, is becoming more and more of a problem in lawns in the Maryland area. Eleven chemicals were tried at three different times during the winter in an effort to discover the best method of controlling chickweed in bluegrass lawns. Probably the most satisfactory chemical was 2,4,5-TP (Silvex). Its use resulted in excellent chickweed control regardless of the time of year at which it was used. However, it is somewhat slow acting, taking at least one month for results to become noticeable. Most of the chemicals gave better results when used in December than when used in March or April, with the exception of Silvex.

(Project B-58-e)

Dalapon, Plus Plowing, Controls Johnson Grass

Experiments were continued with the promising treatment of applying chemicals to Johnson grass and then plowing it down shortly afterward. Here again, of the several chemicals tried, Dalapon gave the best results. Dalapon at rates from 5 to 20 pounds per acre resulted in 85 to 95 percent control of the Johnson grass and disappeared from the soil quickly enough to plant corn three weeks after treatment. Although height of plants at time of treatment appeared to have relatively little effect on degree of control, it was found that control was somewhat more difficult if the Johnson grass was 36 inches or more tall.

(Project B-58-e)

New Management System Produces High Quality Alfalfa

Alfalfa production has been on the increase for some time until now approximately 100,000 acres are grown in the State. Seed availability of superior varieties has largely accounted for this increase along with a better knowledge of the growth requirements of alfalfa. The full potential of these new varieties can only be realized when the best management is used.

It has long been known that early cut forage produces a much higher quality feed than mature hay. However, it has also been generally felt that early cut alfalfa would be less persistent. In 1953 a study was initiated to study some of these factors under Maryland conditions. Results show that the decrease in forage quality from 1/10 bud to full bud has been much less than from full bud to the ½-bloom stage of growth. Making the first harvest earlier than full bud reduced yield and improved quality only slightly. Harvesting later than full bud sharply reduced quality and increased yield very little, if any.

The addition of orchardgrass to alfalfa increased total forage production and, in general, improved the quality of the first harvest mainly because lodging and leaf losses were reduced. However, alfalfa-grass stands require different management than stands of alfalfa grown alone. Early spring harvests of alfalfa-orchardgrass combinations reduce the vigor and stand of the alfalfa more than when grown alone.

Alfalfa varieties differed in their response to cutting schedules in that Narragansett appeared to be more aggressive than Vernal and was therefore damaged less by the early cutting.

(Project B-56-n)

Profit Shown From A Ton Of Fertilizer On Tobacco

Profitable use of fertilizer for tobacco at rates of 2000 pounds per acre of 4-8-12 were shown. Not only were yield and dollar value per acre increased, but quality as measured by price per pound was highest with the most fertilizer. An increase in plant population to about 7000 per acre resulted in moderate increases, as did split-band application of fertilizer. Treatments combining all favorable practices averaged 1309 pounds per acre, $753 per acre and 57.5 cents per pound. The average of the least acceptable combinations was 917 pounds per acre, $471 per acre and 51.4 cents per pound.

(Project B-60)

Tayland Wheat Continues Outstanding Performance

Continued effort is made to obtain better wheat varieties and improved cultural practices. Regardless of source, promising experimental strains of soft red winter wheat are included in the local nursery for observation and screening. A few of the more promising ones are moved up to drill-plot testing against established varieties. The most recent variety to move up from the nursery is the fly-resistant variety, Dual. The dry spring of 1957 limited yields. Most varieties in the advanced field tests stood up well and produced on about the same level. Tayland, recently released, and the older variety, Atlas 50, led all 3-location yield averages by about 2.5 bushels per acre.

In the fertility-variety experiment for 1956-57, there were no significant differences except for fertility treatment. Five widely used varieties showed similar response to four levels of fertilization. In some years this has not been the case. Response to nitrogen was pronounced. With other nutrient requirements presumed to be satisfied, 25, 50 and 75 pounds per acre of nitrogen produced 25.2, 32.4, and 34.8 bushels per acre, respectively. Dry weather, doubtlessly, limited yields and lodging. Only at the 75-pound rate was lodging severe.

(Project B-66)

Barley Still Best Small Grain For Feed

In 1957 evaluation work was in progress with winter barley, winter oats and spring oats. Drill plot tests for all three grains were conducted in Prince George's, Talbot and Frederick Counties. A fourth test for spring oats was in Garrett County. In addition, cooperative nursery studies were in progress for all three grains. The widely grown barley varieties, Kenbar, Hudson and Wong maintained good levels of performance. Piedmont, less widely used, proved somewhat more productive in 1957. The old winter oat variety, Lee, continued to perform on a level with modern varieties. LeConte was outstanding for strength of straw. Due to dry spring weather all spring oat varieties did poorly in the two Coastal Plain tests.

Winter barley continued to be the most productive and practical small grain for use as feed in the central and eastern parts of the State. Tough awns on Kenbar and Hudson continued to invite criticism. Winter oat varieties often challenge barley in Eastern Maryland; however, all suffer more winter injury and require earlier planting.

(Project B-67)

Nitrogen Rate For Tobacco Depends On Kind of Cover Crop

Applications of fertilizer nitrogen to balance the supply from winter cover crops should range from 0 to 80 pounds per acre. A variety of combinations have proven highly effective. For instance, ryegrass alone with 40 pounds per acre of nitrogen plowed down and 40 pounds at planting time produced 1540 pounds of tobacco worth $863 per acre. Ryegrass and vetch winter cover with only 20 pounds of nitrogen per acre at planting time produced 1685 pounds of tobacco worth $903 per acre. Other good combinations are rye and vetch with 30 pounds per acre of nitrogen; winter oats and vetch, or winter wheat and vetch with 20 pounds per acre of nitrogen.

(Project B-68)

Attempt to Breed Mildew Resistance in Wheat and Barley

Studies are underway to breed more mildew resistance into wheat varieties now being used in Maryland and other northeastern states, and to contribute to basic knowledge relating to the inheritance of mildew resistance in winter barley. In 1957 seed was harvested from F_1 plants of 23 crosses involving the susceptible varieties, Anderson, Knox, Leapland, Pennoll, Seneca and Tayland, each crossed with two or more resistant strains. F_2 and F_3 plants of these crosses are being inoculated and read for mildew reaction in a growth chamber with light and temperature control. Resistant crosses eventually will be multiplied and field tested for farm use.

In cooperation with USDA the genetics of several physiologic races of barley mildew are being studied.

(Project B-69)

Probabilities of Drought Occurrence to be Determined

Studies of drought probabilities for Maryland are progressing as rapidly as funds and computer equipment permit. Direct measurements of water requirements of field crops have been initiated. Formulas for computing water losses by evaporation and transpiration have been adapted to machine computation.

(Project BOQR-84)

Irrigation Boosts Yield and Value Of Tobacco, Corn and Forage

Response to irrigation by tobacco, corn and grasses was very marked in 1957. Yield of tobacco was increased from 1130 to 1507 pounds per acre, its average price from 42 to 55½ cents per pound, and its value from $473 to

Tobacco on the left, shown 2 weeks before harvest, received no irrigation. Tobacco on the right, shown at the same time, received irrigation at 1.5 inches per week, for a total of 6.75.

$836. Ear corn was increased in yield from 64 to a maximum of 108 bushels per acre. Tall fescue as hay was improved in yield from 2.83 to 4.13 tons per acre with 75 pounds per acre of fertilizer nitrogen, and from 4.28 to 7.36 tons with 300 pounds of fertilizer nitrogen.

(Project BQ-83)

Frederick County Soil Survey Completed

Cooperative field studies and soil correlation inspections with the Soil Conservation Service have resulted in the completion of the soil survey report and the final assembly of the soil map of Frederick County. It is expected that these will be edited and published early in 1959. During the past year more attention was given to integrating our soil units into the 6th approximation of the proposed new system of soil classification. Several meetings and conferences were devoted to this project. In addition, more thought was given to plan a system of compiling and classifying soil survey interpretative data. Several discussions resulted in the selection of important analytical and field data which will be considered for characterization of soil types. A limited number of key soils of Maryland were selected for future characterization.

(Project O-48)

Boron Helps Alfalfa Yields During Drought

Dry seasons tend to accentuate boron shortage. A few dollars invested in boron fertilizer may pay big dividends when the dry season rolls around. In 1957 alfalfa hay yields were increased by as much as ½ ton per acre, where 30 pounds per acre of borax had been applied. Cost of the borax was about $1.30 and the value of the additional hay produced was as high as $25.

(Project O-51)

Studies Emphasize Importance Of Soil Conservation

During the past year the mineralogical analysis of two important Piedmont soils was completed. The clay minerals found in these soils were essentially Vermiculite, Illite and Kaolinite and their relative abundance varies considerably from the surface to the substratum. Kaolinite becomes more abundant with depth in the Chester soils and concentrates in certain horizons in Elioak soils. However in both soils the greatest concentration of Kaolinite is in the substratum. Vermiculite and Illite are more abundant toward the surface. Such a distribution of clay minerals is indicative of an unusual condition in our soils, the younger minerals being nearer the surface and the more weathered ones deeper in the substratum. Other fresh minerals which were found in greater abundance near the surface were hornblende, chlorite and epidote.

This favorable mineral condition in our soils is probably due to surficial windblown or eolian sediments. Erosion can quickly reverse the mineral distribution of our Piedmont soils and bring about a situation where we are cultivating the older, more weathered and less fertile subsoil.

(Project O-54)

Exchangeable Potassium Indicates Soil Supplying Power

The power of soils to supply potassium may be tested by growing successive crops on them and determining the amount of potassium these crops remove from the soils. The potassium removed by two crops of sudan grass and two crops of alfalfa under greenhouse conditions was compared with a newly proposed method of Kolterman and Truog determining "fixed" potassium. The correlation coefficient turned out to be 0.15, indicating the potassium

extracted by this test from different soils was not well related to that removed by plants from the same soils.

On the other hand when the normal ammonium acetate method was used a highly significant correlation coefficient of 0.84 was obtained. This indicates that the exchangeable potassium is a rather good indication of the supplying power of the 25 Maryland soils used in the test.

(Project O-55)

Rotation Increases Yield of Soybeans

Soybeans grown in a rotation of corn, soybeans, wheat with rye-vetch cover after the corn, and sweet clover after the wheat, have yielded 23% more soybeans than plots which were in continuous soybeans with wheat for winter cover. The two-year average yield of the rotation soybeans for 1956 and 1957 was 26.6 bu., while the continuous soybeans yielded 21.6 bu. Rainfall was normal in 1956 and very low in 1957, but the yield increase due to the rotation was about the same on a percentage basis. This has taken place in spite of the use of a wheat cover crop and heavy fertilization at the rate of 100 pounds N, 120 pounds P_2O_5 and 120 pounds of K_2O per acre, which is equivalent to 1000 pounds of a 10-12-12 fertilizer per acre per year. Appreciable differences in yield between the two cropping systems first showed up in 1956, the fifth successive year of soybeans.

Soil tilth and organic matter have also decreased more in the continuous soybean plots than in plots in the soybean rotation.

(Project O-56)

Muriate of Potash Reduces Corn Stalk Rot

In recent years farmers in certain sections of eastern Maryland have suffered corn yield losses as a result of serious infestation of stalk rot. The severity of this disease is thought to be related to the nutritional status of the soil and of the corn plant. Work conducted in other states suggests that nitrogen and potassium and chloride in muriate of potash may play significant roles in stalk rot development.

An experiment conducted in eastern Maryland in 1957 showed that stalk rot damage was reduced by muriate of potash fertilization. The rate of this material required to reduce the disease, however, seems to be too high for a practical means of control.

(Project O-58)

Need More Information on Fertilizing Pure Grass Stands

During the past few years in the Northeast, increased interest has been shown in the production of pure grass forages rather than pure legume or legume-grass mixtures. This interest has been stimulated by several factors, including (1) low-cost nitrogen, (2) grass stands are easier to maintain, (3) soil pH is not as great a problem, and (4) bloat hazards are reduced.

A change in fertilization practices is needed to meet more fully the nutritional requirements of the pure grass stands. Liberal application of nitrogen must be used to get high yielding, good quality forage. Potash and phosphate are also needed in large quantities but little attention has been given to the needs of these elements by grasses fertilized with high rates of nitrogen. Many soils in this area are low in potash. Because of this and the need for more potash as nitrogen level increases, particularly in some plants, more information is needed on ratios of nitrogen and potash in grass fertilization.

Plots of orchardgrass were established in September 1957, to study the effect of various rates and ratios of nitrogen and potash fertilization on yield, longevity of stand and forage quality.

(Project O-59)

Potash Requirements of Forages Studied

There have been many experiments to show the importance of potash in the production of forages. It has been estimated that 40 to 45 pounds of K_2O are needed to produce one ton of alfalfa, and results from studies in areas other than Maryland suggest that an even greater amount of K_2O is required to produce a ton of grass. Other experiments have demonstrated the importance of potash in maintaining stands of perennial forage species.

For Maryland, and other areas as well, it is generally agreed that large applications of potash to forages before seeding, without subsequent annual applications, fail to give as good results as the use of the same total amount of potash applied in annual increments. However, there is lack of agreement as to the time of year that annual application should be made for most efficient use. Also, more information is needed on rates to be used for maximum yield and stand persistence when applied at different times of the year.

An experiment was initiated in the fall of 1957 to study the effect of time and rate of potash application on alfalfa and alfalfa-orchardgrass. Five rates of potash are being applied at six different times annually. This study will continue for several years and results obtained should provide a better basis for making potash recommendations for forages than is now available in Maryland.

(Project O-60)

Study Slow-Releasing Source of Nitrogen

In the management of pure grass stands, whether they be for turf or forages, a relatively high rate of nitrogen fertilization is necessary to keep them green and productive for any prolonged period of time. The nitrogen carriers commonly used are very soluble and subject to leaching. Split applications have proven, in general, to be more efficient than single applications early in the growing season.

Considerable interest has developed in recent years in urea-formaldehyde as a nitrogen source in pure grass stand management. Urea-formaldehyde has the property of being a slow releasing source of nitrogen, a desirable characteristic from the standpoint of reducing leaching losses and providing available nitrogen over a longer period of time than would normally result from commonly used fertilizers. If the release of nitrogen from urea-formaldehyde is large enough to produce optimum growth and if the release continues over the greater part of the growing season, permitting fewer nitrogen applications per year, the use of this material is certainly promising. A pound of nitrogen from urea-formaldehyde is more expensive than a pound from other sources, but if the number of seasonal applications can be reduced from several to one, the saving in labor would compensate for at least part of the higher cost of nitrogen.

Work is under way whereby urea-formaldehyde will be compared to three other nitrogen carriers—urea, ammonia nitrate and ammonium sulfate. During the summer of 1958, tests were conducted with bluegrass and plans are being made to carry out a similar test with a taller growing and higher yielding grass in future years.

(Project O-61)

Surface Mulching Gives Good Corn Yields

Chopped residues from a winter cover crop of rye and vetch may be plowed under or left on the surface to aid infiltration and erosion control. The latter treatment has resulted in corn yields as good or better than conventional plowing in experiments conducted cooperatively over the past three years with the USDA Soil and Water Conservation Research Division at Beltsville, Maryland.

In one set of plots mulched in this manner, the cover crop was cut and removed, then replaced on the surface after the land had been prepared by plowing and disking, so that placement of residues was the only variable in a comparison with conventionally plowed plots.

The plowed plots with residues turned under yielded 36 bushels and the plowed-mulched plots 38 bushels per acre in 1955 without irrigation. With irrigation in 1956 and 1957, the yields averaged 84.3 bushels for conventional plowing and 88.6 bushels for the plowed-mulched plots.

In another series of plots, winter cover crop residues were retained on the surface of some by using mulch-tillage equipment to prepare the soil. Other plots were plowed for comparison. The average yield of the mulched plots in this series for three years of data is 81.6 bushels per acre. The plowed plots had an average yield of 80.6 bushels per acre.

The rye-vetch winter cover crop was allowed to grow until early May in both series of plots to obtain substantial amounts of crop residues.

Weeds were no particular problem on the mulched plots. Pre-emergence sprays were used to give early control and by the time of the first cultivation the residues were broken down enough to make cultivation as efficient on the mulched as on the unmulched plots.

Wheel track planting of corn in residues from fall-planted rye and vetch (on the left). The planter was equipped with stub runners that operated satisfactorily under the conditions shown. Right: Comparison of corn on mulch-tilled and on plowed land. The mulch-tilled planting is on the left.

Short Rotations Good for Tobacco on Sandy Land

Results with tobacco grown on ridged rows in one, two, and three-year rotations over a period of seven years on sandy land indicate advantages for the one and two-year rotations either in frequency of the tobacco crop or in quality of leaf. This information has come from studies conducted cooperatively with the USDA Soil and Water Conservation Research

Division at Beltsville, Maryland.

The two-year rotation shows a gross return of $677 per acre for tobacco as compared to $624 for the three-year rotation or $628 per acre for the one-year rotation.

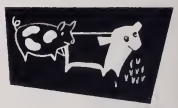
Yields averaged about the same for all three rotations. The higher gross return shown for the two-year rotation is associated with a price per pound of 55.2 cents as compared to 52.0 and 51.1 cents for the one and three-year rotations, respectively.

The failure of the three-year rotation to equal or exceed the two-year rotation in quality and yield in this test appears to be associated with sandy soil in which there is little or no retention of mineral fertilization from one year to the next and the failure on this soil to obtain good stands of legumes or growth of grass in the third year of the rotation.

The one-year rotation may be considered a conservation measure on farms where there is a limited acreage of suitably level land adapted to tobacco production or where land leveling and grading are necessary to control erosion and remove excess water in connection with the tobacco acreage.

The two-year rotation appears to be advantageous on soils where the acreage of suitable land for tobacco is not limiting. The less intensive cropping system aids conservation on rolling land and eases the time schedule on cover crop planting and the preparation of land for tobacco.

ANIMAL HUSBANDRY



Securing the greatest net profit from the production of meat animals depends, to a large extent, on the use of knowledge gained through research and the application of certain arts of the producer. Researchers in the field of Animal Husbandry are continually applying the concepts and techniques of basic sciences to their applied field, securing new knowledge, and testing the reliability of some of the present concepts held by producers.

The new information secured by workers in Animal Husbandry may be, in many instances, immediately applicable to the problems of the producer. In other instances the information lays a firm foundation for subsequent studies which in turn yield results of immediate application. Results from research are published in scientific journals, bulletins, and popular-type articles. Researchers keep in close contact with Extension Service personnel not only to keep abreast of the current problems of the producers but also to pass new information to Extension personnel for transmittal to producers. The persons performing research are also active in presenting their results directly to producers via a number of means of communication such as news and radio releases, field days, short courses, and various types of mimeographs.

Much of the research in Animal Husbandry at this institution is conducted in cooperation with (1) the Departments of Agronomy, Dairy, Microbiology, and the Livestock Sanitary Service of the University; (2) research units of the

and (4) livestock producers in the State of Maryland. The research workers cooperate closely within the department and much of the work is the result of the efforts of two or more persons.
United States Department of Agriculture; (3) packing companies in Baltimore;

Study Started on Low-Magnesium Tetany

A condition in cattle characterized by low levels of magnesium in the blood (hypomagnesmia) and tetany has been a troublesome problem in Garrett County, Maryland and surrounding areas for several years. In beef cattle, this condition occurs most frequently in cows on winter rations and appears to be associated with calving time and early lactation.

The Animal Husbandry and Dairy Departments have initiated a study of hypomagnesemia and tetany which involves the feeding of hay, produced on farms which had affected cattle, to both beef and dairy cows at the University of Maryland. The objectives of this study are (a) to determine if hypomagnesemic tetany can be produced in cows by the feeding of roughages obtained from an area where the disease is prevalent and (b) to use such cows to gain more basic information on the magnesium metabolism of cattle. To date, three beef cows fed hays from Garrett County have developed tetany. This is believed to be the first demonstration that low magnesium tetany can be produced by feeding forages from affected farms to cattle in a herd where the disease has not been known to occur. Preliminary analyses indicated that blood magnesium levels in affected cows were extremely low. The cows responded to magnesium-calcium therapy.

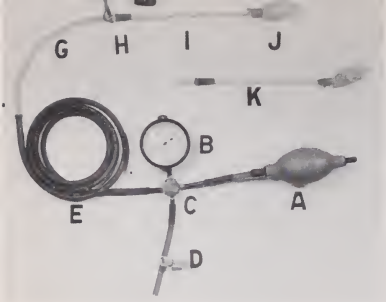
Blood levels of calcium, phosphorous, magnesium, sodium, and potassium in all cows on the Garrett County hay diets are being determined. Detailed mineral analyses of the forages are also being made. Blood mineral levels in cows in the University herd on regular wintering rations are also being determined in order that comparisons can be made. Upon completion of the analyses of blood and forages, it may be possible to make recommendations for the alleviation of low-magnesium tetany in affected areas in Maryland.

(Project G-37)

Develop New Test for Pregnancy

The new test for pregnancy involves the injection of 30 USP units of oxytocin (a hormone from the pituitary gland) into the jugular vein of a cow and then measuring the contraction of the muscles of the vagina by means of an inflated rubber balloon coupled to a pressure gauge. Pregnant cows responded to the test by producing a marked increase in the intra-vaginal pressure relative to the initial pressure recorded prior to the time the effects of the hormone were noticed. Non-pregnant cows which were not in estrus (heat) exhibited no increase relative to initial pressures. Cows in estrus showed some increase over initial pressure, but the pattern of the increased pressure was different from that exhibited by pregnant cows. During other phases of the estrus cycle, the muscles of the vagina did not react to the hormone. Preliminary trials which involved the use of 5, 10, 20, 30, 40, 50, and 60 units of oxytocin indicated that the 30 unit level was the most desirable to use.

A total of 321 cows was given this test for pregnancy in order to study the efficacy of the test. The test was found to be essentially 90 per cent accurate on the basis of all normal



Apparatus used for measuring changes in vaginal pressure: A= Double acting squeeze bulb hand pump (60 ml. capacity), B= Manometer (300 mm/Hg capacity), C= "4 way" junction, D= Air release hose and pinch type stop cock, E= Rubber tubing (3' x 3/16"), F= Jointer (3" section of plastic, artificial insemination catheter), G= Flexible plastic tubing (12" x 14"), H= Jointer (2" section of 3/16" rubber tubing), I= Catheter (9" section of artificial insemination catheter), J= balloon (thumb or finger portion of surgical rubber glove), K= Vaginal balloon-catheter section, L= Spring clamp.

cows tested. The accuracy of diagnosis was determined by estimating "actual" pregnancy through the use of herd records, rectal palpation of the reproductive tracts of some individuals, and autopsy reports on three individuals. The cows known to be pregnant were grouped on the basis of two week intervals of their period of gestation. The test was found to be essentially 90 percent accurate during all biweekly segments of the period of gestation with the exception of the three-and-one-half and four month intervals. The test was found to be highly accurate during both the first two weeks of gestation and during the second two weeks of gestation. No ill effects from the test such as abortions, etc., were noted.

The test for pregnancy, as developed, is simple and rapid to perform; the equipment is easily portable; and the test gave highly accurate results even during the earliest stages of pregnancy. If similar results are obtained by other researchers using the technique, the new technique should be of great practical importance to both beef cattle and dairy cattle producers.

(Project C-30)

Work Continues on Performance Testing

Weaning weights and rates of gain while on test were secured on 58 Angus bull calves on the farm of a cooperating producer. Data from last year's calves were analyzed in reference to the gains made during the first 14 days and the subsequent 140 days of a 154 day feeding trial. Essentially no correlation existed between the gains made during the first 14 days and the subsequent 140 days of the trial. No advantage was found in weighing the calves on two successive days at the start and the end of the trial relative to using the weight of one day only at the start and the end of the trial.

(Project C-14)

Increased Gains Result from Group Feeding

The last weights of the calves in the third and final trial in the comparison of group vs. individual feeding of weaned beef calves were taken on May 20, 1958. Calves from the University of Maryland beef herds were weaned and started on feed in the second week of October and fed for 224 days in each of the three trials. A total of 62 Angus and 70 Herefords were used and they were allotted at random for group or individual feeding by sire, breed, and sex. They averaged approximately eight months of age and 480 pounds in weight when weaned.

The results of all three trials were similar in that calves fed in groups gained more rapidly on the average than those fed individually. This was also true each year in each of the four sub-groups (namely: Angus steers, Angus heifers, Hereford steers and Hereford heifers). On the average, the group-fed calves consumed more feed per head daily than the individually-fed calves but the feed consumed per unit of gain plus maintenance varied considerably and was not consistant throughout the trial.

The results of these experiments indicate that where calves on gain test trials in record of performance studies are individually-fed, their expected daily gains would be somewhat less than if they were group-fed. Not only is the cost of equipment and labor greater for individually feeding but the gains are reduced as compared to group feeding.

Detailed scores and measurements of the calves were secured at the beginning and end of each feeding trial. These scores and measurements will be studied in relation to rate and efficiency of gain.

(Project C-14-d)

Research on Type Classification Summarized

Selection of breeding stock by means of visual evaluation has been practiced probably since man first started domesticating livestock, and various types of scoring systems have been used in the past. In only comparatively recent times have studies been made concerning the closeness of agreement among people scoring calves or for finding the amount of variation among

Records of performance can aid greatly in the improvement of a herd. Above: Cows representative of the kind in the herds of the University 10 years ago. Below: excellent type cows representative of many in the herd at the present time. Replacements have been selected on the basis of scores of conformation and weight and feed records, as developed from research findings which form the basis for present recommendations.

scorers when they simultaneously score the same animals.

The results from this study have been used benefically in that the scoring system used in the "Maryland Beef Cattle Improvement Program" was built around the results from this project. The scoring sheet involving many portions of the animal's body and the scoring of animals above or below the base value of 100, which was set equal to the "Ideal" animal, has been used to a limited extent but appears to be practical for the producer wishing to secure a detailed analysis of each animal in his herd and of his herd as a whole.

(Project C-14-b)

Study Rumen Function in Lambs

The significance of the amounts and molar ratios of volatile fatty acids (VFA) produced in the rumens of sheep on various diets or treatments is being studied. In addition to investigations on the effect of diet, research is also being conducted to develop further techniques for the study of VFA production.

During the past year, the short-time incubation of freshly drawn strained rumen fluid has been investigated as a method of determining VFA production *in vitro*. To date, results with two-hour incubations of rumen fluid indicate that the method is a simple and rapid means of making qualitative studies of VFA production by rumen microorganisms. It is known, for example, that high concentrate-low roughage rations will result in nearly equal amounts of acetic and propionic acids being produced in the rumen, and that high roughage-low concentrate diets result in a preponderance of acetic acid. Rumen fluid differences in the proportions of acetate and propionate in sheep fed such diets can be corroborated by VFA production in short-time *in vitro* incubations. Two-hour incubations have been compared with 24 hour incubations of washed cell suspensions (WCS). The two-hour incubation is a more rapid and less laborious method and more accurately reflects the amounts and proportions of VFA in the rumen fluid than does the WCS. Rates of VFA production in either method are not as high as calculated production in the rumen of the animal. These observations have been confirmed in studies with uniformly labelled C^{14} glucose. (C^{14} is radio-active carbon)

The effect of frequency of feeding upon VFA production in the rumen and upon the performance of fattening lambs is also being investigated. In work completed to date, feeding seven times per day did not affect the rate of gain of the lambs or the molar ratios of VFA in the rumen when compared to the twice-a-day feeding of identical rations.

(Project C-25)

Study Effect of Procaine Penicillin on Bloat

Studies designed to determine the role of rumen microorganisms in bloat are being conducted. Investigations of the effect of procaine penicillin (an antibiotic) upon gas production and volatile fatty acid (VFA) production have been initiated. These studies include work on both feed lot bloat and legume pasture bloat.

Two "bloat" diets (61% ground barley, 16% soybean oil meal, 22% ground alfalfa hay and 1% salt) have been fed to lambs. The diets were identical except that one contained procaine penicillin at a level of approximately 8.0 milligrams per pound of diet or approximately one half ounce per ton. Two groups of four lambs each were

fed the "bloat" diets for 16 weeks. The initial feeding level was 2.0 pounds of feed (16.0 milligrams penicillin) per lamb per day and was increased to 3.5 pounds of feed (28.0 milligrams of penicillin) per lamb per day by the 13th week of the trial. Samples of rumen contents were drawn by means of a stomach tube from all lambs after 2, 8, 14, and 16 weeks on the "bloat" diets. Analyses of rumen fluids showed that total VFA were slightly higher in pencillin-fed lambs than in control lambs (no penicillin) and that fatty acid production in rumen fluid incubated in the laboratory was also higher in rumen contents drawn from the penicillin-fed lambs. *In vitro* gas production by rumen microorganisms was measured manometrically. The feeding of penicillin did not affect the amount of gas production in this trial. While no explanation can be given for the slightly increased VFA production in the penicillin fed lambs, it is obvious that penicillin did not decrease activity of the rumen bacteria as measured by fatty acid and gas production. The penicillin fed lambs showed less tendency to bloat than did the control lambs, though the incidence of bloat was not high in either group.

The feeding of 10, 15, or 20 milligrams of procaine penicillin by capsule to ewes grazing on alfalfa pastures did not affect the amounts or proportions of VFA present in the rumen or produced by rumen bacteria *in vitro* when samples were drawn 2 to 24 hours after penicillin feeding. Differences in rates of gas production as a result of penicillin feeding could not be demonstrated. Twenty-three cases of slight to moderate bloat were observed in 13 control animals while 18 ewes fed penicillin did not bloat under the conditions studied (observations made within 24 hours after single administration of pencillin).

(Project GC-45)

Protein May be Reduced During Breeding and Gestation

Previous investigations conducted at this station revealed that a reduction from 15 percent (the recommended level) to 10 percent in the crude protein content of breeding and gestation rations for sows had no apparent detrimental effects upon reproduction. However, when the lower crude protein level (10 percent) was continued throughout lactation, a marked reduction in weaning weights, "bloom", and uniformity resulted.

The investigations conducted during the fall and spring seasons of 1957-1958 were designed to determine whether or not feeding of the lower protein level during the breeding and gestation periods was a factor in the unfavorable results observed when this level was continued throughout the lactation period. This objective was accomplished by feeding paired groups of breeding females equal amounts (pounds) of rations containing the two protein levels during the breeding and gestation periods. During the lactation period both groups were fed the ration containing 15 percent crude protein.

The results suggested that feeding of the 10 percent protein level during breeding and gestation had no detrimental effect upon performance of the pigs during the nursing period.

The results on reproduction achieved by the feeding of the two protein levels during the breeding and gestation periods in these trials were similar to those observed during 1956-1957. No differences attributable to protein level were detected upon number of matings per conception, total number of pigs born per litter or number born alive, average birth weight, or vigor

at birth. Indications are that the recommended allowances of crude protein for female swine during the breeding and gestation periods may be lowered to 10 percent of the total ration.

(Project C-23)

Two New Worming Compounds Found Promising

The 1957-1958 investigations of worming compounds (anthelmintics) for swine added piperazine dihydrochloride (Verban) and hygromycin B (Hygromix) to the list of new materials studied at this station. Since piperazine dihydrochloride is a soluble compound it was administered to one group of swine (10 head) in the water and to a second group of 10 head in the feed. A sodium fluoride treated group and an untreated group were used again as the standards for comparison.

The different types of parasites found to be present in this investigation included large intestinal roundworms, stomach worms, nodular worms and whip worms.

Both hygromycin B and piperazine dihydrochloride administered in the feed proved to be extremely effective in the removal of large intestinal roundworms. Examination of the intestinal tracts following slaughter revealed these compounds to be 100 percent and 98.6 percent effective, respectively. Evidence based on egg counts of fecal samples taken from the individual pigs indicated that both compounds were also relatively effective in the removal of stomach worms. The nodular worm and whip worm infestations indicated by initial egg counts, disappeared independent of treatment prior to the completion of the trial.

When piperazine dihydrochloride was administered in water, unfavorable results were observed which suggested that the product in water was sufficently unpalatable to cause the pigs to avoid drinking it. Since the product was administered during winter weather a different result might be observed during hot weather.

Sodium fluoride proved to be the only product administered in the feed that showed evidence of being unpalatable or toxic to the pig. When given to pigs approximately 70 days of age, only about 50 percent of the recommended 24 hour intake was consumed and extensive vomiting followed. Also, rate of gain was 5.4 percent slower and feed requirements per unit of gain 8.2 percent higher than for the untreated group over the 87 day test period. The fact that in previous work at this station similar unfavorable results have been observed following sodium fluoride administration suggests the recommendation of its use be discontinued.

(Project C-24)

Copper and Aureomycin Effect Rate and Efficiency of Gain Alike

The effectiveness of antibiotics in improving rate and efficiency of gain of swine is generally believed to be closely related to the non-specific disease level existing on the premises. Also, this effectiveness normally diminishes as the age and weight of the pig increases. In the previous trial (1956-1957), conducted in dirt drylots which had been used by swine during two previous seasons, chlortetracycline (Aureomycin) and all levels of copper investigated improved feed efficiency rather markedly (about 10 percent). This improvement in feed efficiency was most marked during the period from weaning to 125 pounds in live weight. Also, prior to 125 pounds in live weight all treatments appeared to have had a favorable effect on rate of gain. The pattern and magnitude of the pigs' response to copper and

chlortetracycline additions to the ration were remarkably similar.

The 1957-1958 trial was conducted on pasture land that had never been used previously by swine in an attempt to determine if the responses to copper and antibiotic feeding would continue to follow a similar pattern under conditions conducive to a minimal response to antibiotics. Under these conditions neither Aureomycin at the rate of 10 grams per ton of feed nor copper at the rate of 32 or 64 parts per million (¼ or ½ pound of copper sulfate, blue vitriol, per ton of feed) had a favorable effect on rate or efficiency of gain. However, the combination of the antibiotic and copper at the rate of 64 p.p.m. increased the rate of gain 10.9 percent.

The similarity of the responses of swine to additions of copper or antibiotic to the ration under conditions believed to vary greatly in non-specific disease level rather strongly suggests a similar mode of action. However, the marked response of the combination under conditions suggestive of a minimal response needs further study.

(Project C-27)

Pelleting of Mixed Rations Containing Barley Advised

The most effective utilization of feeds available on the farm is a goal of every producer. Since barley is an important crop produced on many Maryland farms, swine producers have been interested in finding means of more effectively utilizing this grain in their swine production programs.

An exploratory investigation conducted in 1956-1957 revealed that the pelleting of barley-containing mixed rations for swine greatly increased their feeding value. The 1957-58 investigation was designed to gain additional evidence on this point and to compare barley-containing mixed rations in the pelleted form with corn-containing mixed rations (not pelleted). These investigations were conducted on concrete floored feeding pens in order to minimize the effects of waste of feed.

Swine fed barley-containing mixed ration in the pelleted form gained 12.7 percent faster on 9.5 percent less feed per unit of gain than swine fed the same rations in the meal form. Further, the group fed the pelleted barley-containing mixed rations gained 5 percent faster on 2.7 percent less feed per unit of gain than similar swine fed corn-containing mixed rations.

These results suggest that the pelleting of barley-containing mixed rations will permit this grain to be used fully as effectively as corn in swine production and during periods of a favorable price relationship, more profitably. Also, the problem of waste of feed will be reduced to a minimum.

(Project C-28)

Free-Choice Method of Feeding Reduces Cost

Investigations with growing-fattening swine, studying the effects of method of feeding upon performance and costs, were continued during 1957-1958. The performance of swine fed conventional complete, mixed rations was compared with that of swine fed shelled corn and one of two types of protein supplements by the free-choice method in drylot. Protein supplement no. 1 contained 25 percent meat and bone meal whereas supplement no. 2 contained no animal protein. Both protein supplements contained soybean oil meal, dehydrated alfalfa meal and vitamin, mineral, and antibiotic additives. The group fed the completed, mixed ration received a mixture of ground corn and supplement no. 1 in proportions that provided a level of 16 percent crude protein in their diet from 50 to 125 pounds in live weight

and 13 percent thereafter. Both groups fed shelled corn and supplement selected a protein level of 12.9 percent up to 125 pounds in live weight and 11.3 percent thereafter.

For the period from 50 to 200 pounds in live weight, the free-choice fed groups gained 7.2 percent faster on 7.4 percent less feed per unit of gain and consumed 19.0 percent less protein supplement than those fed complete, mixed rations. Most of the differences resulted after the groups weighed 125 pounds in live weight. (Additional work is in progress to find at what weight it might be most profitable to change from feeding a complete, mixed ration to free-choice feeding.) Small differences in performance and costs between the groups fed the two protein supplements by the free-choice method were found. This suggests that properly fortified supplements based on proteins of plant origin only are adequate for good performance.

Results and observations to date indicate that it may be most profitable to start pigs on complete, mixed rations and shift to free-choice feeding at approximately 75 pounds in weight. Also, the present emphasis upon the feeding of complete, mixed rations to growing-fattening swine may be founded more on fad than fact.

(Project C-29)

BOTANY

Research in the Department of Botany includes projects designed to yield information useful in solving immediate problems in the field, as well as projects of a more basic nature designed to yield information of the kind upon which all progress in science ultimately rests.

The scope of the research in progress in the Department of Botany is indicated by the brief reports of projects that follow.

Produce Peppers with Male Parent Only

Multiple seedlings, arising from polyembryonic seeds, have been found in pepper. The twin and triplet pepper seedlings frequently have haploid members. Haploids from multiple seedlings have only half the usual number of hereditary units and derive their hereditary factors directly from the female parent.

During the past year, haploid peppers were isolated for the first time from seeds with single embryos. One of the monoembryonic haploids showed fruit and foliage characters of only the male parent. The isolation of a paternal haploid from a genetically marked cross shows that a sperm, rather than an egg, functioned in the development of the haploid plant.

Although the frequency of haploids is primarily controlled by the hereditary constitution of the female parent, X-irradiation of the pollen resulted in an increase in the frequency of monoembryonic haploids in one of the experimental lines of pepper. Following

treatment of the pollen with 1000r units of X-rays, five percent of the seeds of the experimental line yielded haploids. Ordinarily, less than one percent of the seeds of pepper produce haploids.

(Project F-15-b)

Study Factors Affecting Asparagus Rooting

Plants of stock were exposed to temperatures of 55°, 65°, 75°, and 85°F. during the flowering period in order to determine the effects of temperature on seed production. The temperature of 85°F. resulted in complete sterility due to pollen and ovule abortion. The maximum production of seeds occurred at 65°F.

"Toughness" of asparagus was found to be associated with thickening of cell walls in the fibre ring and tracheary elements of the stem. Individual spears were split; one-half of each spear was stored dry and the base of the other half placed in shallow water. Deterioration of quality, due to thickening of cell walls, occurred to a greater extent in dry storage.

A mist system has been devised to continuously supply nutrients and other additives to cuttings in order to study anatomical and physiological factors affecting rooting. This study will correlate seasonal variations in rooting with changes in stem anatomy. The ultimate aim of this study will be to determine the anatomy of the stem at the time of optimal rooting in order to improve the frequency of rooting at less favorable seasons.

(Project F-16)

Develop Method to Speed Seed Germination of Trees

A forest tree improvement program using conventional breeding techniques requires a great amount of time. Twin seedlings occur in several forest species. If haploids were present among these twins, true breeding lines could be obtained in a relatively short time.

Investigations conducted during the last year have shown that twinning occurs more widely among forest species than was previously suspected. Twins were found in all species studied intensively.

The seeds of many tree species will not germinate until they have gone through some type of a dormant period. This dormancy may be broken by 15 minutes to four hour scarification (depending upon the species involved) with concentrated sulfuric acid, by four months stratification at 40° F., or by various other chemical treatments. It was found that giberillin would not substitute for all or part of the cold period for the 9 species studied.

(Project F-17)

Organic Mercury Most Effective Scurf Control

During the past year, 27 varieties of sweet potatoes were tested for susceptibility to scurf in field plots. All sprouts were inoculated with the scurf pathogen prior to planting in the field. Records at harvest time indicated that all varieties were susceptible to scurf; however, there were differences in degree of susceptibility among the 27 varieties.

A number of fungicidal dips were tested for field control of scurf. Prior to planting in field plots, scurf-infected sprouts were dipped in the following fungicides: theram, captan, maneb, zineb, ferbam, and an organic mercury (Puratized Agricultural Spray). Results recorded at harvest time indicated that the organic mercury gave superior control of scurf.

(Project J-86-a)

Evaluate Fungicides for Vegetable Crops

The 1957 growing season was unusually dry and as a result diseases of many vegetable crops occurred sporatically in field test plots of fungicides.

Results of field tests for evaluation of fungicides for control of seedpiece decay in potatoes and for control of fruit and foliage diseases of cucumbers and downy mildew of broccoli at the Vegetable Research Farm at Salisbury were inconclusive. At another location, however, zineb gave remarkable control of downy mildew of cantaloups.

In tomato spray plots at Salisbury early blight and gray leaf spot developed abundantly in August and September. In these experiments maneb and a spray schedule of four applications of zineb followed by four of maneb gave excellent control of these foliage diseases. Yields of fruit were greater from all of the plots treated with fungicidal sprays than from the unsprayed check plots, but the differences were not statistically significant.

In the laboratory it was shown that the fungitoxic portion of the captan molecule is apparently the $SCCl_3$ group. This group is released from the inside portion of the molecule by sulfhydril compounds such as cysteine, glutathione and coenzyme A. This toxic group undergoes conversion to thiophosgene. Combination of thiophosgene with certain chemical groups in components of the cells apparently accounts for the fungitoxicity of this fungicide.

(Project J-91)

Continue Study of Antibiotic Substance from Streptomycete

Further study has been made of an antibiotic substance that has antifungal activity and is produced in cultures of a streptomycete that was isolated some years ago from Maryland soil. Progress has been made in concentrating and purifying this material and limited greenhouse experiments suggest that it may be of value in control of certain fungus diseases of plants. Additional experimental work will be necessary to determine whether it possesses any advantages over fungicides currently available.

(Project J-92)

Increase Supply of Disease-Resistant Tobacco Seed

Seed from the Maryland black shank-resistant variety tentatively designated as Mor-59 has been distributed to a number of growers in the tobacco counties. Seed build up of the black shank-resistant variety will be made in 1958 to be held as a reserve in the event that growers will need the seed for the future.

Work will be continued on developing tobacco resistant to mosaic, root rot, wildfire, Granville wilt, anthracnose, and aphids. The F_2 progeny of a cross showing resistance to anthracnose shows a high degree of resistance. Eighty percent of the F_2 cross survived infection as compared to 80 percent mortality of the suspectible parent.

(Project J-93)

Soil Treatments Control Pathogenic Soil-Borne Fungi

Experimental control of soil borne pathogenic fungi with chemicals can be readily demonstrated in the greenhouse. Tobacco was used as a test plant. Two soil borne fungi, one causing black root rot and another causing black shank of tobacco, were the test organisms. Preliminary tests showed that a number of chemicals drenched on the soil would control both organisms. Several of the chemicals proved to be fungistatic, and as soon as they were washed out of the soil, plants were infected or killed. One chemical was definitely fungicidal against the fungus causing black shank. This chem-

Black root rot of tobacco controlled by use of chemical soil drenches. Check (CK) at right is uninoculated, untreated control. All incolulated, untreated control plants died.

ical will be field tested in 1958.

Attempts to control the black shank fungus by low temperatures were tried on wet and dry soils. Indications are that the fungus will survive in the wet soils regardless of the temperature, even when sub-zero temperatures were used.

(Project J-95)

Black shank of tobacco controlled by use of chemical soil drenches. Check (CK) at left is untreated, with plants dead.

Continue Study of Plant-Parasitic Nematodes

A continuation of the state-wide nematode survey indicates that many woody plants, especially boxwood, azalea, blueberry, and peach, are affected by plant-parasitic nematodes. A new apparatus for separation of nematodes from the soil was constructed that is a modification of Seinhorst's method. It has been demonstrated that control of nematodes on many established plants, including those listed above, is possible with the nematocide 1,2-dibromo-3-chloropropane.

Several new species of nematodes attacking plants in Maryland have been discovered and are being identified. Variation within species is being studied in an attempt to clarify the species concept in nematodes.

Inoculation of plants with various species of nematodes have been made to determine pathogenic effects. Azalea decline has been associated with high populations of the stylet nematode, *Tylenchorhynchus claytoni.*

(Project J-96)

Typical symptoms of azalea decline, showing little leaf, twig dieback and chlorosis. This condition is often associated with attacks of the stylet nematode, Tylenchorhynchus claytoni.

Isolate Nematoxic Substance from Asparagus Roots

Asparagus was found to be one of the few plants not attacked by the stubby-root nematode, *Trichodorus christiei*. Soil surveys in Maryland and other states have shown that asparagus is relatively free from attack by other nematodes as well.

Once fleshy storage roots have formed, stubby-root nematodes no longer will feed on asparagus plants and populations of nematodes in soil around asparagus roots are rapidly killed off. Population decline is much more rapid than can be accounted for by starvation and this decline takes place even if host plants are present in the same pot.

A toxic glycoside has been isolated from asparagus roots, and from the soil near these roots, which kills nematodes in 0.01 percent aqueous solutions. The compound also kills stubby-root nematodes feeding on tomato roots when 0.1 percent aqueous solutions are either sprayed on the leaves or drenched into the soil.

This is the first recorded case of a compound which moves downward through the stem and is active against a parasite of the roots. Studies are being carried further to study the effects of this and similar compounds on other plant-parasitic nematodes.

For the first time a compound which may be useful for control of nematodes by spraying is known and opens up an entirely new approach to this problem.

(Project J-97)

Isolate New Ulrus; Propose Name for it

In cooperation with the Crops Research Branch of the U. S. Department of Agriculture a new virus, infectious to beans, was isolated from naturally infected peas. In host range studies 29 species (representing 5 families of plants) of the 46 plant species tested were found to be susceptible to the virus. All of 30 varieties of beans that were inoculated were susceptible. On the basis of its host range, symptoms, and physical properties, the name, pea strain of the tobacco-streak virus, is proposed for the new virus.

In another phase of the work preliminary investigations are under way to develop an improved method of assay for the tobacco mosaic virus.

(Project J-98)

Study Factors in Boxwood Decline

A survey of boxwood plantings on the Eastern Shore of Maryland revealed that the decline is most severe in the Easton (Talbot County) area and that young plants, as well as old established plantings, are affected.

All attempts to isolate *Phytophthora cinnamomi* (believed by some workers to be an important factor in the decline) have failed, however, the fungus was isolated from species of *Rhododendron*. On two occasions unidentified species of *Fusarium* were isolated from affected boxwood plants.

Several parasitic nematode species were identified from soil samples taken in affected plantings, however, they were not found in all affected plantings. Species identified were: *Rotylenchus buxophilus, Xiphinema americanum, Trichodorus, primativus, Tylenchorhynchus* sp., *Pratylenchus* sp., and *Hemicycliophora* sp.

A greenhouse test to determine whether there is a correlation between soil drainage and infection was set up using two isolates of *P. cinnamomi* (the new isolate from *Rhododendron* and an isolate made in the laboratory some years ago were used in this test), but the experiment is still in progress and results are not yet available.

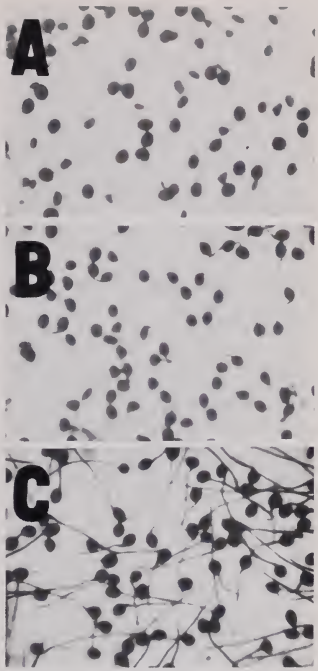
(Project J-99)

Study Role of Boron in Plants

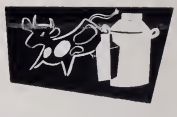
Inasmuch as phenylboric acid complexes with sugar in the same way as boric acid, experiments are being conducted to determine whether phenylboric acid can satisfy the plant's requirement for boron. If it does, this would be evidence for the Gauch-Dugger theory that boron reacts with sugar to make sugar-boron complexes, the latter moving more readily throughout the plant than ordinary, non-borated sugar molecules.

Recent research with lily pollen corroborates earlier findings concerning the importance of boron for pollen (see picture). For boron to exert its favorable effect on germination of pollen, the boron must be added to the sugar solution prior to the extrusion of the pollen tubes. In the presence of gum arabic, along with sugar, boron may be added somewhat later and still be effective.

(Project K-8-c)



Beneficial effects of gum arabic — and particularly of boron — on the germination of lily pollen. A, 715% sucrose solution; B, 7.5% sucrose + 1% gum arabic; and, C, 7.5% sucrose + 1% gum + 5 ppm of boron, as boric acid. Picture taken 1¼ hours after start of germination.



Significant advances have been made during the past year in our knowledge of the processes involved in the metabolism and utilization of nutrients for milk production. This information, and that obtained from studies on the feeding value of forages, will enable dairymen to produce milk more efficiently and economically.

Results of research in dairy technology have increased our understanding of the factors responsible for the flavor of cheese, dried milk and other dairy products. New information has been obtained concerning desirable physical and chemical properties of ice cream and sherbets. Consumer acceptance of these products has also been evaluated.

Cheese Flavor Compounds Identified

A significant contribution to knowledge of the complex chemistry of cheese flavor has been made. It has been discovered that aldehydes, of the type resulting from the Strecker degradation of amino acids, play a prominent role in cheese-flavor. Of these aldehydes, methional (3-methylthiopropoanal) has been found to be the most important in contributing to the characteristic flavor of cheese.

(Project G-35)

Develop New Method for Separating Flavor Compounds

An efficient quantitative chromatographic procedure has been developed for separating 2,4-dinitrophenylhydrazones. These hydrazones are widely used as a basis for identification of carbonyl compounds. The chromatographic partition system employs nitromethane on Celite or the stationary phase, and hexane as the mobile phase. The behavior of over 40 different compounds has been studied, including hydrazones of C_1-C_{12} saturated aldehydes, C_3-C_{13} saturated ketones, C_3-C_{10} enals, hydroxy-ketones, furfural derivatives, and sulfur containing carbonyls. The chromatographic technique will provide a valuable tool for the separation and identification of flavor compounds in a variety of foods.

(Project G-34)

Flavor Compounds Identified in Nonfat Dry Milk

Study of factors affecting the flavor quality and flavor stability of instant nonfat dry milk has been continued. Particular attention has been directed to elucidate the mechanism of cereal-stale type of flavor development in this product. The following flavor compounds have been identified in instant nonfat dry milk: methyl sulfide, diacetyl, isobutyraldehyde, isovaleraldehyde, furfural, hydroxy-methylfurfural, hexanal, heptanal, octanal, nonanal, decanal, and dodecanal. The identified flavor compounds demonstrate that the mechanism of flavor deterioration in nonfat dry milk involves both the browning reaction and lipid oxidation. This work will provide a basis for developing improved practical methods of manufacturing and packaging for this new dairy product.

(Project G-48)

Browning Reaction Studied

Research has been continued to obtain a fundamental understanding of the nature of the formation of the brown color and flavor compounds when milk is heated to high temperatures and/or stored for extended periods of time. The isolation, characterization, purification and identification of the products formed in milk by such treatments have been attempted. Previous studies, using solvent extractions and derivative formation in these solvents, resulted in derivative degradation during the isolation and purification procedures. The extraction procedure used during the past year was a steam distillation technique in which the volatile substances were fractionated from the heated milk, condensed, and trapped in refrigerated flasks. 2,4-dinitrophenylhydrazine derivatives were formed in the condensate. The derivatives are being purified for identification, using various column partitioning methods.

(Project G-40)

Rapid Chemical Changes in Reconstituted Dry Milk

It has been discovered that freshly reconstituted dry milk is in a dynamic chemical state. Some of the characteristic products of the protein-sugar browning reaction disappear rapidly (within a few minutes) when dry milk is reconstituted with water. This discovery has practical application in demonstrating the need for standardization of the time and analysis of reconstituted dry foods by some of the commonly used quality control tests for products of the browning reaction. It also has fundamental significance in helping to explain the mechanism of the browning reaction in concentrated and dry foods.

(Projects G-35 & G-48)

Domestic "Feta" Cheese Developed

Studies have been completed on the development of a manufacturing procedure for a commercial domestic "Feta" cheese in which pasteurized milk was used. Previously, cheese of this type was made from raw milk and was dependent upon the normal bacterial flora and enzymatic system of milk for its curing. *Streptococcus lactis* and *Lactobacillus casei* cultures and a mixed commercial pre-gastric esterose from the kid and the lamb were used to develop this cheese. It was cured in a three percent salt solution. The resultant cheese possessed a pickled, slightly rancid, salty and piquant flavor with a soft, creamy and soluble body and texture.

(Project G-40)

Improve Quality of Sherbets

Previous reports have shown that substantial improvement in body and texture of sherbets was accomplished by using various combinations of sweetening agents. Studies were continued to determine the physical and chemical properties, handling properties and consumer acceptance of representative sherbets selected from previous studies.

The sherbets containing corn syrup solids and low dextrose equivalent corn sugar showed important improvements in physical and chemical properties. These products can be handled and stored under conditions comparable to those for ice cream.

Results indicate that consumer preference between the sherbets studied was of little significance.

(Project G-42)

Study Physical State of Fat in Ice Cream Mix

A study of the physical state of the fat in ice cream has been made by light transmission with a Beckman Spectrophotometer, with special reference to the effect of the homogenization and freezing processes and mix components. The results indicate that there are factors present, related to fat particle size, that influence the light transmission characteristics of ice cream mix. These should be given consideration in evaluating the results of light transmission tests. These factors do not seem to be present in normal whole milk.

It appears that further information concerning the physical state of ice cream may be obtained by the use of light transmission and microscopic techniques.

(Project G-42)

Test Feeding Value of Early-Cut Alfalfa

A study to determine the management practices which will produce the greatest amount of milk per acre from alfalfa is being conducted in cooperation with the Agronomy Department.

The first cuttings, taken at one-tenth bud, full bud, and one-half bloom, have been fed to 12 lactating cows to determine their relative value for milk production. In addition, digestion studies have been conducted on the first cuttings and on the second, third, and fourth cuttings from the same fields harvested at one-half bloom.

Results from the two previous years and current preliminary results show an increased consumption rate for the earlier cut alfalfas. In addition, the early cut hays were more digestible and supported a higher rate of milk production. The total yield of nutrients per acre appears to be greatest when the first harvest is made at the full-bud stage.

(Project G-47)

High Levels of Grain Feeding Successful

Groups of cows were fed 80%, 40%, and 20% of their energy intake from concentrates during the entire lactation. This amounted to approximately 24 pounds, 12 pounds, and 6 pounds of concentrates per head per day. The cows receiving the highest level of concentrate produced the most milk and provided the greatest return above feed cost under the conditions of the experiment.

Approximately 30.0% and 7.0% more energy was required per pound of 4% milk for the cows fed 80% and 40% of their energy from concentrates, compared to those receiving 20% from concentrates. No differences were detected between the groups in regard to evidence of mastitis, udder edema or breeding efficiency.

It appears that during periods of shortage of forages, dairy cows may be safely and economically fed rather high levels of concentrates.

(Project G-39)

Dried Apple Pomace a Desirable Feed

During a 120-day feeding trial, dairy heifers fed 4 pounds of dried apple pomace per head per day, and U. S. No. 2 alfalfa hay free choice, grew at the same rate as similar heifers fed corn meal in place of apple pomace. Digestion studies with dried apple pomace indicated that this material contained 67% T.D.N. and 125 therms of digestible energy per 100 pounds. There was little or no digestible protein present. Apple pomace can be recommended as a useful feed for dairy cattle when used as a bulky concentrate in a ration containing ample protein.

(Project G-39)

Study Chemical Pathways in Liver with Radioisotopes

In preparation for investigations of changes induced in dairy cattle by certain hormones, the oxidative patterns of normal cow liver, as studied with volatile fatty acids (major end-products of fermentation in the rumen, with the exception of formate) labeled with radioactive carbon have been established, using a chromatographic-autoradiographic technique. The label from each acid had its own distinctive pattern on the chromatograms. All acids appeared to be readily utilized with the exception of acetate. The major incorporation of the carboxyl carbons of the various acids into non-volatile compounds is as follows: formate into glucose and phosphate esters; acetate into beta-hydroxybutyrate, glutamate and citrate; propionate into malate, aspartate and lactate; butyrate into beta-hydroxybutyrate and glutamate; valerate into beta-hydroxybutyrate and beta-hydroxyvalerate. There was little incorporation of butyrate into three carbon intermediates, while valerate incorporation was distributed most widely.

(Project G-46 & NE 30)

Cows With Ketosis Have Abnormal Liver Metabolism

The metabolic pathways of liver slices obtained by biopsy from cows with ketosis have been studied by means of a chromatographic-autoradiographic method. It was noted that liver tissue of ketotic cows use propionate normally, but that formate, butyrate and valerate were metabolized differently.

A technique for surgical removal of the adrenals of cows was developed to obtain more information on the role of the adrenal in ketosis (acetonemia). Adrenalectomized cows were hypersensitive to cortisone for several weeks, but eventually became adapted to adrenalectomy, indicating either growth of new adrenal tissue or other tissue providing the essential adrenal hormones.

In cooperation with the Animal Husbandry Department, hay from farms in Garrett County experiencing "grass tetany" was purchased and fed for four to six months to beef and dairy cows at the University. Three cows developed "grass tetany". This appears to be the first time that this condition, which occurs in all parts of the world, has been so reproduced.

(Project G-37)

Control of Rumen Fermentation Now Possible

Investigators in the Dairy Department, cooperating with members of the Bacteriology and Animal Husbandry Departments, are able to control to a marked degree the manner in which feed is digested and converted into end-products in the rumen. The breakdown of starch, cellulose and protein of feed in the rumen to volatile fatty acids can now be controlled and altered within wide limits and the fat content of milk may be altered at will by controlling the proportions of these acids in the rumen. The feeding of heated concentrates, especially when fed with pelleted hay will effect a milk fat test as low as 1 percent. The incubation of rumen fluid from cows on normal diets and low milk fat producing diets with radioactive glucose resulted in marked changes in the end-products produced from the glucose, demonstrating that alterations in the bacteria are responsible for the changes within the rumen and in milk fat test.

It was demonstrated that most bacteriological media will not support normal growth of rumen bacteria; one media was developed which was almost as effective as normal rumen fluid for this purpose. It was demonstrated that rumen bacteria are solely responsible for the urease activity of rumen fluid.

(Project G-39)

Use Radioisotopes to Study Role of Organs in Feed Utilization

By means of a mechanical "heart" and "lung", the rumen, the liver, and the udder have been kept alive after the sacrifice of the animal. Using such preparations and various metabolites common to the ruminant and labeled with radioactive carbon, the following have been established: the perfused rumen is more representative of the rumen of the live animal than any "artificial rumen" yet developed; the absorption of fatty acids into the blood from the rumen reflects their production in the rumen; butyric, acetic and propionic acids, after production in the rumen, pass into the blood as such; the perfused ruminant liver converts formic, propionic, and butyric acid, but not acetic acid primarily to carbohydrate, acetic acid apparently being used more directly by other body tissues; the perfused lactating udder was shown to produce milk lactose, protein and fat from formate (formate was shown to be produced by the liver), the radioactivity in the short chain fatty acids of milk fat being such as to indicate a stepwise synthesis of these acids in a manner not previously proposed or expected.

(Project G-43 & G-38)

Continue Cooperative Study on Bloat

Cooperative studies by investigators of the Dairy, Animal Husbandry, and Microbiology Departments demonstrated the following: Using washed suspensions of rumen bacteria, it was found that alfalfa saponin decreased the gas production from cellibiose by 28 to 45%, but did not change the production of gas from glucose; rations made up entirely of pelleted alfalfa hay produced mild bloat; the volatile fatty acid production in the rumen was not appreciably different between bloating and non-bloating animals on diets of alfalfa pellets; the feeding of 10-25 mg. of penicillin per head per day did not affect the rates of gas or volatile fatty acids produced in sheep on alfalfa pastures or in lambs in dry lot.

(Project GC-45)

Study Hormone Secretion in Milk Production

The hormone systems of the cow are involved in the regulation of udder growth, milk secretion and the persistency of milk secretion. Knowledge of the mode of action and amounts of hormones required for optimum milk production should allow the selection and management of cattle for more efficient and economical production.

A technique involving radioisotope dilution has been developed for the study of the secretion rate of adrenocorticotrophic hormone (ACTH) in dairy cattle. In conjunction with this, methods for the isolation and quantitative estimation of ACTH were adapted to cattle blood.

Preliminary results indicate a blood concentration of ACTH in dairy cattle ranging from 0.1 to 1.0 milliunits per 100 ml. of blood and a secretion rate of from two to ten units per hour.

(Project G-50)

Study Characteristics of Rumen Bacteria

Using previously developed techniques, the first reported isolation of an obligately anaerobic, urea-hydrolyzing, authentic rumen bacterium, was accomplished by cooperative work between the Dairy and Microbiology Departments. The organism was tentatively classified as a *Lactobacillus* sp. The factors governing the isolation of the important urea-hydrolyzing bacteria from the rumen have been elucidated.

The starch hydrolyzing bacteria population of the bovine rumen, as influenced by "normal" and abnormal starch concentrations in the diet, has been shown to be remarkably high. Approximately 90 percent (10 ^{7}per gm. act. wt.) of the cultivatable rumen flora of animals fed normal rations was found capable of hydrolyzing starch. Intact starch granules (soluble, potato, corn) were only slowly attacked by rumen bacteria. Freshly drawn rumen fluid shows only slight amylase activity, but frozen, thawed rumen fluid appears to have greatly enhanced activity.

In efforts to produce "artificial frothy bloat", gum guar (a galactomannan) was studied. It was rapidly decomposed by the rumen bacterial flora. The organisms involved appear to be unique to the rumen. The enzyme ("guarase") is extracellular, and cell-free preparations are being studied (optimum pH, effect of metals, etc.) using viscosimetric techniques. The enzyme appears quite stable under usual laboratory conditions.

The factors influencing the results obtained with washed cell suspensions of rumen bacteria (WCS) have been studied in order to more adequately define the parameters of the method. The following factors were found to influence the production of lower fatty acids and lactic acid by WCS: (1) time of sampling; (2) buffer and substrate concentration; (3) sodium carbonate and CO_2 atmosphere; (4) freezing; (5) presence of rumen fluid; (6) incubation time; (7) pH; (8) end-products present initially.

The factors influencing the stability of the rumen bacterial flora were investigated. The fatty acids present in rumen liquor appear to prevent many non-rumen contaminants from establishing themselves in the rumen. It was found that certain peptides and amino acids could successfully prevent the inhibition of *Escherichia* coli (an intestinal but non-rumen organism) by high concentrations of propionic acid.

(Project G-45)

ENTOMOLOGY

The protection of crops and animals from insect damage is an essential activity in all phases of agriculture. The Department of Entomology constantly seeks refinements in chemical control and conducts investigations which contribute to a better understanding of basic facts of insect life.

Environmental Factors Important in Corn Earworm Control

Corn insects are affected in many ways by natural environmental factors. Research conducted by the Department of Entomology has shown that an understanding of these complex factors can assist the grower of sweet corn in his insect control programs.

The corn earworm is controlled with DDT — oil emulsion sprays applied to the silks. The timing of these sprays is determined by the population level of corn earworm which in turn is dependent largely upon weather conditions and summer rainfall. Growth con-

ditions for the corn plants also affect the proper timing of corn earworm treatments. From year to year these conditions vary, but generally, if a single treatment is contemplated it should be applied when from 75 to 90 percent of the plants are in silk. If more than one treatment is planned, the first application should be made earlier.

(Project H-29-m)

Test New Insecticides for Snap Bean Pests

Ten insecticides, including several promising new chemicals, were tested in the field for effectiveness against the Mexican bean beetle, the potato leaf lopper and the corn earworm. At dosages applied of all insecticides except demeton and Thimet gave good control of the Mexican bean beetle; parathion, Diazinon, Sevin, Thiodan and Trithion were as effective as Dilan and malathion. There was greater difference in the performance of the insecticides against the potato leaf lopper than against the Mexican bean beetle. Sevin, Thiodan and Trithion gave excellent reduction of nymphs, but only on Dilan treated plots was nymphal development completed inhibited. Parathion, Sevin and Thiodan gave complete control of the light infestation of corn earworm that was present. None of the insecticides cause off flavor in the canned product.

(Project H-29-l)

Pea Yields Increased by Better Insecticides

Prior to the time DDT became available to Maryland pea growers, pea yields averaged 1728 pounds per acre. DDT became available in 1946 and was widely used through 1952; during this seven-year period the average pea yield in Maryland increased to 2231 pounds per acre, 419 pounds above the previous nine-year period. The phosphate insecticides became available in 1953, and malathion has been widely used since that time for pea aphid control. During the five years, 1953 through 1957, the average pea yield per acre for Maryland was 2254 pounds, a 526 pound increase over the 1937 to 1945 period. These increases resulted largely from successful aphid control on the Eastern Shore of Maryland; aphids occur nearly every year and cause more severe damage to peas in this part of the state. Some canners in this section have during the latter period, 1952 to 1957, increased average pea yield better than a half ton peas per acre over the 1937 to 1945 period. Along with increased yield, the quality of peas has also been considerably improved.

As more effective aphicides have become available, it has been found that treatments should be applied earlier. When rotenone was used as an insecticide for pea aphid control, treatments were not made until aphid populations reached 50 to 100 or more per sweep of an insect net. At the present time when malathion is being used, sprays applied when aphids reach 10 to 15 per sweep are giving best results.

(Project H-64)

Continue Investigations of Cabbage and Broccoli Insects

Experiments on insecticides for control of cabbage looper, imported cabbage worm and cabbage aphid were continued during the past year. Malathion, Perthane, toxaphene, Trithion, Dibrom and Thiodan, applied weekly, gave complete protection against the imported cabbage worm while Diazinin and Thiodan gave complete control of the cabbage aphid. None of the insecticides used completely controlled the cabbage looper. Best results were secur-

ed with Thiodan, Dibrom and a spray containing both Perthane and malathion.

For adequate protection sprays must be applied weekly and thorough plant coverage is necessary. Results indicate that to secure thorough spray coverage at least four drop nozzles are necessary in addition to one or two nozzles directed downward on the plants from above. One pair of drop nozzles should be carried low and directed slightly upward to cover the undersides of the leaves. This under leaf coverage is necessary since loopers feed on the lower leaf surfaces.

On large plants it is necessary to increase the volume of spray used per acre; 100 gallons appears to be necessary on maturing plants.

When infestations of imported cabbage worm are present on cabbage at least two nozzles directed downward from above the plants should be used. It is necessary that all leaves composing the outer portion of the head be thoroughly wet with spray.

Until residue tolerances are established for some of the new insecticides, such as Thiodan and Dibrom, a spray combining Perthane and malathion will be recommended for use in Maryland on cabbage and broccoli.

(Project H-46-f)

Mosquitoes Don't Transmit Filarial Worms to Small Mammals

Recently discovered filarial worms infect raccoons, skunks, squirrels and other small mammals in Maryland. These parasites are close relatives of exotic species which cause disease in man.

With the cooperation of the Department of the Army, Office of the Surgeon General and of the Department of Interior, Fish and Wildlife Service investigations were carried out to determine whether or not mosquitoes will transmit filarial parasites from one mammal to another.

Experiments were conducted with 12 species of mosquitoes. Mosquitoes which fed on infected animals usually ingested microfilariae, but larval filariae usually failed to develop. Some development of parasites from a gray squirrel occurred in one species of mosquito, *Anopheles punctipennis.* None of the worms developed to the infective stage.

(Project H-73-b)

Develop Combination Spray for Codling Moth

During the past 4 years there have been reports from various states which indicate that the codling moth is becoming resistant to DDT. Since the first reports of resistance appeared experiments have been conducted at the Hancock laboratory in an effort to find a suitable substitute for DDT.

Many combinations of insecticides, fungicides and miticides have been tested. Some of these combinations proved as effective against codling moth as the standard DDT program. Also some of these combinations resulted in better foliage and higher quality of fruit. One combination was outstanding and was used in some commercial orchards during 1957. This combination consisted of lead arsenate, Ryania and parathion. In addition to giving better control of codling moth than was obtained with DDT, the combination also controlled red-banded leaf roller, suppressed orchard mites and was valuable as a fungicide. Commercial growers using this schedule praised it highly, and it is anticipated that it will be followed by many growers.

(Project H-48)

Test New Methods for Orchard Mite Control

The European red mite and the two-spotted spider mite have become major problems to the fruit grower. It appears that they build up resistance to certain materials within a comparatively short period of time. It is therefore essential to test new materials each year in order to have a suitable substitute for the older miticides that may become ineffective.

Materials have been tested in the delayed dormant period, pre-blossom period and summer applications. Previous experiments indicated that the most effective treatments were the ones applied before the mite population began to increase. This is especially true in regard to the European red mite. The delayed dormant application of oil plus one of the phosphates gives good control of the European red mite until around the first of June. This can also be accomplished with pre-bloom and early post-bloom applications of Systox and one or two other materials. The Systox application in addition to controlling mites gives good control of rosy apple aphids which eliminates the necessity of either dormant or delayed dormant sprays. The two-spotted spider mite, which usually appears in midsummer, has been successfully controlled with one or two applications of Aramite or Kelthane.

(Project H-69)

HOME ECONOMICS

In recent years the U. S. Department of Agriculture has reported an increase in the annual per capita consumption of fat from 125 grams per capita per day in 1909 to 141 grams per capita per day in 1949. The frequent eating of foods relatively high in fat content, such as fried fish, fried chicken, spaghetti, pizza, potato chips, french fried potatoes, is relished by the public. Common diets containing such foods would have a fat equivalent to 40-45% of the total daily calories. Will this change in food habits affect health?

Study Effect of Quality of Fat on Protein Utilization

An increase in fat eaten means that an increase in calories is eaten. This could account for the increase in body weight of some Americans. If increased fat and calories are eaten, is protein utilized to the same extent as when less fat is eaten? When the protein of the diet is low, a large amount of fat would be expected to exert a sparing action on protein so that less nitrogen would be excreted than on the average low protein diet.

In animal experimentation the relationship of protein and fat metabolism has been studied with interesting results by several groups of workers. The exchange of fat for carbohydrate in protein containing meals caused a greater nitrogen excretion than occurred after a similar exchange in meals containing no protein. Greater loss of amino acids in the feces was found in rats fed low fat diets. Some workers report fat was well utilized when the

protein content of the diet was low. Others report that lower protein intake was associated with a lower fat digestibility.

Two diets were used to test some of these facts with college women. One contained fat to the extent of 36% of the total calories, and the other contained fat equivalent to 48% of the total calories. The protein of both these diets was 12 grams for fifteen days, then it was increased to 35 grams for fifteen days, then it was reduced to 12 grams for fifteen days.

The diet was analyzed for protein and fat. It contained common foods low in protein. On the 12 gram level of protein, no meat or fish was eaten. When the protein was increased to 35 grams, half the subjects ate the supplementary protein as beef, half ate it as haddock. During the final period the protein of the diet was mainly plant protein again. The fat of the diet was largely margarine. The diet was adequate in minerals, vitamins, and calories. The criterion for adequate was the maintenance of body weight.

The calories eaten by these subjects averaged 3000 calories. The fluctuation in body weight was less than one pound over the six-week period.

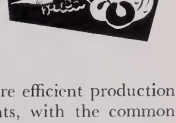
Meat and fish dinners were used in the study of protein diets at the high intake levels.

Excretions were collected as in metabolic experiments and analyzed each 3-day period for protein and fat. The nitrogen retention was found to be slightly higher for the subjects that had eaten the higher fat diet. However, the difference in retention was not statistically significant.

This study indicated that the higher fat diet could be well utilized, and that it increased protein utilization slightly. There was no indication of detrimental effects of the higher fat diet for the length of time of this experiment.

(Project Y-1)

HORTICULTURE



The efforts of Horticultural research are aimed at more efficient production of better fruits, vegetables, flowers, and ornamental plants, with the common goal of higher returns for the producer and better products for the consumer. The research program thus involves studies ranging from plant breeding to the canning and freezing of fruits and vegetables, carried on in the laboratories and greenhouses at the University, on the experimental farms, and on the farms and orchards of cooperating growers throughout the state.

Some of the recent results of the research program are briefly presented in the following pages. More detailed information is available in scientific journal papers, station bulletins, and popular articles released by the Experiment Station. The research laboratories, greenhouses and farms of the department are open to those interested in horticultural research, and growers and processors are cordially invited and urged to attend the various programs, field days, and meetings where the most recent research findings are presented directly to the producer.

Continue Vegetable Variety Studies

A continuous and exhaustive variety testing program for commercially important vegetables is maintained to provide the industry with necessary detailed information on variety capabilities.

The most significant contributions recently made are the highly recommended snap bean, Tendercrop; lima bean, Thaxter; and sweet corn, NK 199. Tendercrop, formerly 1831-9, is widely adapted, has concentration of set, high yielding ability and excellent quality particularly for freezing. Yields of two tons of beans with a fiber content of 0.15% in the five and six sieve grade were obtained from a single mechanical harvest.

Thaxter, formerly US 255, is essentially a Thorogreen type with a very high degree of resistance to Downy Mildew. It is adapted to Maryland conditions and produced good yields. Thaxter is no better than Thorogreen in quality but has the added features of being more tolerant to high temperature and drought conditions.

The sweet corn variety, NK 199, is a main season corn used for both whole kernel and cream style canned packs, and for freezing. It has large ears with narrow, deep kernels with a high percent cutoff, and is tolerant to drought.

The screening of numerous breeding lines for possible acceptance and eventual release form an integral part of the testing program. One of the most important characteristics evaluated in snap bean screening is concentration of set of pods, a feature of greater importance with the acceptance of the mechanical bean harvester.

(Project O-74)

Test Improved Equipment for Planting Peas

Double-disk openers, designed to be interchangeable with conventional openers on some current drills, are now commercially available, and were tested in seven locations. A seed chute between the disks restricts lateral movement of falling seed thereby effecting single file placement. A firming wheel, following closely behind the point of contact of the seed with the furrow bottom, presses the seed firmly into the soil.

The openers worked efficiently in sandy soils, in loams and silt-loams, and in soils containing large amounts of shale.

The openers were tested at all locations at tractor speeds of 4 and 6 mph and at 8 mph at three locations. There was no difference in emergence, stand or yield among the plantings at any location. Approximately 6 mph was the fastest speed at which most tractor drivers could plant. Greater uniformity of emergence was observed in peas planted with the double-disk openers than with the single disk or hoe openers.

(Project O-77)

Select Asparagus Twins for Breeding Work

In asparagus it is known that twin seedlings occur at a frequency of 0.7 to 1.0% and that approximately 5% of these twins will segregate haploid plants. If the chomosomes of haploid lines are doubled by colchicine treatment of the young crowns, it should be possible to obtain genetically homozygous lines. The conventional method for obtaining homozygous lines in most crops is through inbreeding. However, asparagus is a dioecious, perennial crop and inbreeding by the conventional method is not feasible, because: (1) Sibling is the closest inbreeding possible in commercial lines, (2) flowering occurs in the field 2 years after seeding, (3) progenies should be evaluated at least 4-5 years in the field, (4) plants require approximately 7 sq. ft. in the field which limits greatly the number of lines and the number of plants which can be evaluated.

A search for twin seedlings began at this Station in 1957. Since then 125 twins have been isolated. Many of these will be discarded on the basis of sex since haploids in dioecious lines should all be females. All females that set abundant fruit and seed will be discarded also since haploids are generally sterile. Root tip smears of the remaining plants will be observed for chromosome number.

An attempt will be made to obtain haploid male plants from hermaphoditic lines. The ultimate objective of this breeding program is to obtain as many "doubled-up" haploids as possible, to cross them in all possible combinations, and to evaluate these combinations for commercial possibilities.

(Project Q-74)

Continue Snap Bean Breeding

In 1955-56, 12 commercial bush varieties were crossed with Blue Lake 92 pole variety. Selections having Blue Lake pod characteristics were made from selfed progenies for the past 3 years. Most selected lines are now at least 4 generations removed from the original crosses. In 1957 samples were processed from 27 selected lines and rated organoleptically as to flavor. Of these lines, 8 were considered as having a flavor similar to Blue Lake.

Records taken on plant and pod characteristics of individual plants from which pod samples were processed and tasted, indicate that there is no correlation betwen flavor and any other factor that would be a practical aid in selecting for flavor of the Blue Lake type.

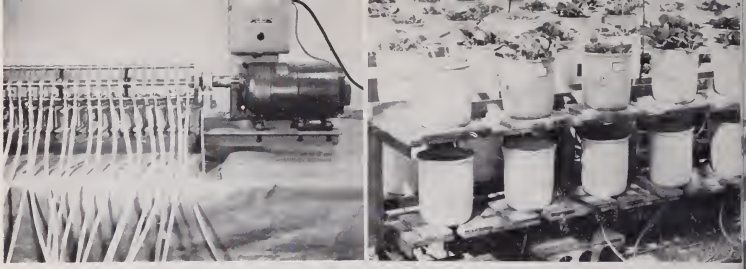
Some progress is being made toward obtaining a snap bean adapted to Maryland that would exhibit the flavor so much in demand by consumers.

(Project Q-74)

Automatic System Devised for Nutrient Culture Use

A new technique has been developed which promises to give more reliable results in carefully controlled studies of the mineral nutrient needs of plants. Difficulties have been encountered in producing completely normal growth of some kinds of plants in sand culture. Under the bright warm days of spring for example, large cauliflower plants approaching edible maturity in the greenhouse have shown severe wilting for several days at a time when nutrient solutions or distilled water were added two or three times daily by hand.

A new system for automatic application of nutrient solutions in sand cul-



This hose pump apparatus (shown on left) was devised to apply nutrient solutions automatically to experimental plants. Right: upper pots contain the experimental plants growing in sand. Lower pots hold the solutions which are applied to the pots above. The hose pump is located below the lower tier of pots.

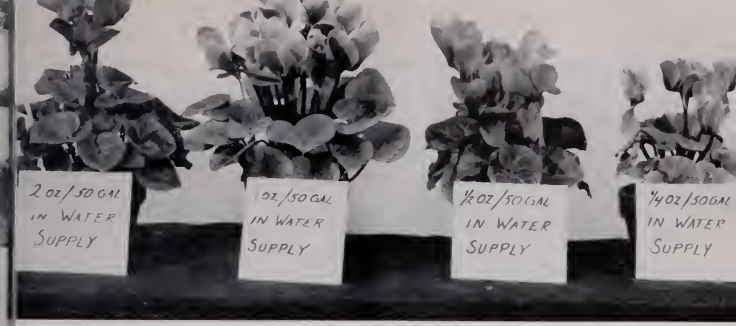
ture studies was designed and built by personnel of the Department of Agricultural Engineering and the Department of Horticulture. The accompanying illustrations show the important parts of the apparatus. It utilizes a bench with double rows of glazed containers. The upper container holds the experimental plants growing in pure white sand with the lower pot serving as a reservoir for the nutrient solution which the plants in the upper pot are to receive. Excess nutrient solution drains back into the reservoir for reuse.

The heart of the system is an electrically operated hose pump located below the lower tier of containers. This pumps the nutrient solutions from the reservoir through chemically inert polyethylene hose into the upper pot containing the experimental plants. The system is controlled by time clocks and applies the solutions once per hour for as much of the day as is desired, usually during the hours of daylight. The total amount and rate of application of the nutrient solutions can be controlled within narrow limits. As many as 108 different nutrient solutions can be applied individually to as many different pots at one time by the present system. It can be expanded further if desired.

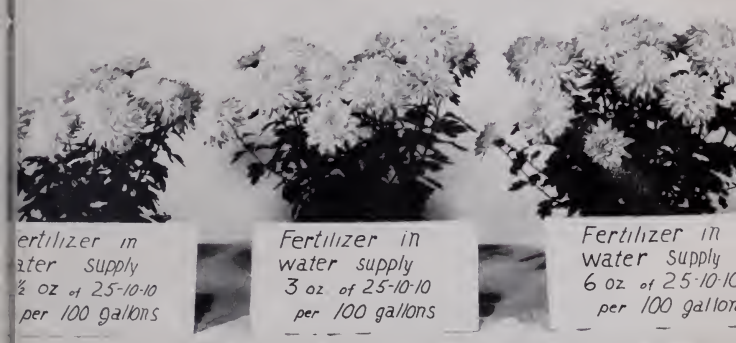
Preliminary tests of the equipment have given excellent results. Reasonably normal growth of cauliflower was obtained even under the unfavorable temperatures of early summer.

(Project Q-79-h)

Azaleas were successfully grown with soluble fertilizers in the water supply. These plants of the variety Dorothy Gish received differential amounts of 25-10-10 fertilizer in this manner.



Cyclamen fertilized with differential rates of 25-10-10 fertilizer in the water supply. Show marked differences in growth and flowering.



Water soluble fertilizers proved efficient in the production of greenhouse chrysanthemums, variety Bonnaffon Deluxe. Higher rate of application of 25-10-10- fertilizer produced larger flowers and larger, greener foliage.

Modified Atmospheres Don't Help Stored Sweet Potatoes

Modified atmosphere storage has not proved to be beneficial in storage tests with sweet potatoes. Lowering the oxygen content and/or increasing the carbon dioxide content of the storage atmosphere was ineffective in decreasing the rate of dry matter loss caused by respiratory activity. When the oxygen level was maintained below 10 percent, or the carbon dioxide level about 10 percent, definite deleterious effects were obtained in the form of off-flavors and the development of necrotic areas on the surface of the roots.

In other storage tests with sweet potatoes, employing a five day curing period at 85 degrees F. and subsequent storage at 55 to 60 degrees with continual maintenance of high humidity. definite varietal differences in storage

behavior were obtained. Nemagold, Maryland Golden, and Jersey Orange have a relatively short storage life, with analysis showing rapid disappearance of carbohydrate reserves during storage, and consequent lowered edible quality. Porto Rico, Sunnyside, and the recently introduced variety, Oklamar, remain in excellent condition after storage of six months or longer.

(Project Q-84, Q-79-g)

Test Shows Promise in Measuring Lima Bean Maturity

Thirteen varieties of lima beans including baby limas, large seeded Fordhooks, and baby Fordhooks harvested at four different maturities have been measured for maturity changes by use of an Adams Consistometer. The theory being that as the lima bean matures it becomes more starchy, thus, the addition of a standard amount of water and a standard blending procedure should give a slurry of varying densities and different flow characteristics.

The relationships between flow of the raw slurry on the Adams Consistometer plate and shear press readings (lb/force) was $r = +.947$. The correlation between consistometer readings on the raw slurry and alcohol insoluble solids (A.I.S.) of the canned product was $r = +.927$. From these relationships it can be seen that the slurry method may be used on the raw beans as a good indicator of quality and also it has a very high correlation with A.I.S. of the canned beans which is one of the best chemical tests for quality.

In the canned product the slurry test vs. A.I.S. of the canned beans does not show such a high correlation, $r = +.815$. The range is short in the slurry test apparently due to some change in the starch structures of the heat processed product.

(Project Q-58-p)

Blend Found Best for Apple Sauce

Good apple sauce blends are the result of combining varieties which will impart an optimum flavor, color, texture, and consistency to the product. For example, Golden Delicious variety will contribute a bright golden color and good body to the sauce but is lacking in acidity. Stayman Winesap and Jonathan will impart acidity, but the Jonathan has a low color potential and poor body. York Imperial, after a short storage off the tree, imparts good flavor and body but is slightly lacking in acidity. Immature apples probably should not be used in the blends unless acidity is desired and if a grainy texture is needed. Green apples also impart a poor color and a very thick consistency. Fully mature apples of different varieties blended as harvested from the tree generally give a premium quality sauce. It has been found that York Imperial, Stayman, Winesap, and Golden Delicious of about equal proportions give an apple sauce of good quality.

In another study of factors that make up the overall quality of sauce, it has been found that the flavor was weighted about 45%, color 35%, texture 15% and consistency 5%. From this study about 80% of the estimation of quality was derived from flavor and color. Therefore, varieties which contribute favorable to these characteristics should be included in apple sauce blends.

(Project Q-58-p)

Develop Statistical Procedure for Pricing Vegetables

Processors of vegetables frequently pay growers on a quality grade basis. Such sliding scales of payment assume that the higher quality raw material is of greater value to the processor, and consequently he is prepared to pay a higher price for this added quality. However, since certain crops such as

sweet corn and lima beans may be relatively low yielding when harvested at a very early stage of maturity which is usually associated with top quality, there may be a point at which harvesting at an extremely young stage of maturity may not bring a maximum return to the grower. At the same time a relatively low yield in terms of cases per ton may affect the canner or freezer similarly.

A statistical procedure was developed by which information previously developed at this station on the relation of yield to quality, and quality to price of the finished product, is utilized in order to arrive at the best solution which would bring the maximum benefit to both processor and grower.

The data are presented in terms of families of curves on graphs, where the best solution coincides with the point of the quality scale where the curves of processing costs show the greatest overlap on the curves of growing returns. *(Project Q-58-f)*

Leaf Scorch of Lilies Due to Nutritional Conditions

Leaf scorch of Croft lilies is a physiological disorder which has caused severe injury to the lily crop forced in greenhouses. While the exact cause is still not known it appears to be nutrional and can be controlled by certain liming and fertilizer practices now that the basic relationships are known. Two types of leaf injury occur which are not necessarily due to the same factors. Browning of the lower leaves appeared to be a deficiency of phosphorous and nitrogen. Browning of the tips of the mid and upper leaves of the plant are more prevalent under acid soil conditions. This type of injury may be increased by nitrogen and phosphorus fertilization but is alleviated by calcium fertilization.

Results of several years experiments have shown that these disorders of Croft Easter lilies can best be controlled by liming the soil to a pH of 6.5 to 7.0 and regular fertilization with a 25-10-10 fertilizer during the forcing period.

(Project I-74-a)

Long Stems on Roses Possible by Pruning

Long stemmed roses command a higher price on the market and so the production of these longer stems may be just as important as producing a greater number of roses from an economic standpoint. Studies just completed on methods of cutting and pruning roses showed the benefits of certain little known practices. During the preblooming period while the plants are growing, the removal of the flowering tips is practiced. If all of the stem tips were removed at a very young (immature) stage the resulting plants produced both more roses and longer stemmed roses. Also if instead of the normal method of cutting flowers, the plants were permitted to make one more flush of growth and then flowers were successively cut lower on the plant (undercutting) still longer stems were produced. It was thus shown that a combination of immature topping of all shoots followed by the practice of undercutting resulted in rose stems which averaged four inches longer with but little reduction in the number of roses produced.

The same experiments showed that best results may be obtained by leaving all of the leaf bearing branches on the plant irrespective of whether they actually produce flowers or not. This finding is contrary to most commercial practices.

(Project I-74-b)

Reduce Bacterial Wilt of Carnation

The frequency of the bacterial wilt of carnation, *Pseudomonas caryophylli,* was found to be significantly reduced in plants having a low nitrogen content in the soil. Carnations growing in greenhouses are often subject to attack by this bacterium which causes the plants to wilt and die. Experiments at this station and elsewhere have shown plants more susceptible under certain conditions of the soil acidity and nutrition and likewise to be resistant to Bacterial Wilt under other conditions. More recent experiments at this station have clarified the effects of several factors and made possible more specific recommendations of value to growers. Heavy fertilization with either nitrogen or phosphorous resulted in a greater susceptibility of the plants to Bacterial Wilt. Practical recommendations to growers include using a soil low in pH but with a calcium fertilization to avoid a calcium deficiency, low phosphorus fertilization and reducing the nitrogen fertilization if plants become affected with this disease.

(Project I-74-b)

Continue Spray-Thinning Studies on Apples

It has been shown by others that the concentration of naphthalene acetic acid (NAA) used for spray-thinning of apples may be sharply reduced simply by adding one pint of Tween 20 (oxyethylene sorbitan monolaurate), a wetting agent, to 100 gallons of NAA solution. Basic studies have demonstrated that greater absorption of NAA by leaves takes place in the presence of Tween 20.

Spray-thinned apples after the "June drop". Left: unsprayed. Right: sprayed 15 days after full bloom with NAA.

In 1957 experiments designed to study the orchard performance of this mixture, all trees used had been subjected to three consecutive nights of frost. Under these circumstances, it was found that with one pint of Tween 20 per 100 gallons, 2½ ppm of NAA failed to produce enough thinning, 5 ppm of NAA thinned well, and 10 ppm overthinned. By varying the Tween 20 concentration with a standard 5 ppm of NAA, it was found that on these "frostbitten" trees ¼ and ½ pints of Tween were as effective as one pint per 100 gallons of water.

Timing studies indicated that the apple thinning spray should not be applied earlier than two weeks after full bloom, whether or not additives such as Tween 20 are used. Also, sprays applied at 50 to 65 percent relative humidity in the morning, and again to other trees in the evening at 100 percent relative humidity showed that high humidities do not render the thinning spray more effective as has been supposed by many.

(Project I-74-b)

Control Weeds Around Young Apple Trees Chemically

Weeds and grasses growing around young apple trees compete with the trees for water and nutrients, and also increase the hazard of mouse injury to tree trunks and roots. A number of chemicals are available for the preven-

Chemical weed control in the young apple orchard. Left: weed growth around untreated apple tree. Right: bare soil around young tree, 6 weeks after spraying with a germination inhibitor.

tion of weed-seed germination.

To study the possibility of using some of these germination inhibitors in the young apple orchard, two chemicals were used around 1-year-old Golden Delicious trees on May 28, 1957. Materials and rates applied were Karmex (3-(p-chlorophenyl)-1,1-dimethylurea) at 1 and 2 pounds per acre, and Sesone (sodium 2,4-dichlorophenoxyethyl sulfate) at 2 and 4 pounds per acre. The materials were applied to freshly prepared, moist soil in a water solution.

Treated areas remained virtually free of vegetation throughout the season and little difference was found in the effectiveness among the chemicals and rates of application. It is likely that the failure of weed seeds to germinate in late summer was due in part to the extremely dry 1957 season. Treated trees sustained no injury from either compound used.

(Project L-74)

Chemical Control of Poison Ivy Used in Apple Orchard

Lush growth of poison ivy in Maryland orchards continues to plague the fruit grower and all concerned with production and harvesting of the crop.

To determine effective and economical means of dealing with the problem, several growth regulating compounds were applied in June, 1957, to poison ivy growing under mature Golden Delicious apple trees. Materials were applied at the rate of two to three gallons per tree as a low-pressure directed spray. Compounds and rates per 100 gallons used were: amino triazole, 2 and 4 lbs.; 2,4,5-T (amine), and 2,4,5-TP (propylene glycol butyl ether esters), 1 and 2 quarts.

All compounds at the rates used produced complete killing of the above-ground parts of all poison ivy plants before the growing season was over. The longevity of control from these treatments will be determined in 1958. Some premature fruit ripening indicated that an ester-type formulation may be less desirable than non-ester types.

All of these chemicals are potent and should be applied with caution on non-windy days to avoid contacting tree foliage.

(Project L-74)

Chemical control of poison ivy in the apple orchard. Left: lush growth of ivy before spraying. Right: same tree 35 days after spraying, illustrating typical results obtained with several growth-regulating compounds.

Calibrating Testing Equipment

In a program of developing testing equipment for quality factors in vegetables careful attention must be given to the possibility of calibrating such equipment so that different units will provide the same values on identical samples. For this reason many otherwise promising principles for measuring the quality factors of horticultural products had to be abandoned, and work was concentrated on certain basic units which could be so calibrated.

The Hunter color-difference meter was found to be a satisfactory means of measuring color of different products, only if properly calibrated, by means of a specially devised reference tile, which must be well within the region in color space covered by the specific item.

Similarly, the shear-press is a satisfactory means for measuring textural-rheological characteristics, only if properly calibrated, by means of a proving ring dynamometer.

(Project Q-58-f)

New Tomato Grade Proposed

Present methods for grading tomatoes for processing are inadequate because they fail to reflect the quality of the finished product, and are based on human rather than instrumental evaluation.

The proposed grade consists of deductions for unusable tomatoes, and those requiring trimming plus the cost of removing such material.

These deductions are made from the total weight and payment would then be made only for the usable weight on a quality scale as measured by the Hunter color difference meter.

(Project Q-58-f)

Evaluating Pesticides for Possible Off-Flavors

Some of the new pesticides which were found to be effective in controlling diseases or insects on crops may cause an objectionable off-flavor. Since in many cases there is no way of determining such a flavor change except by actually tasting the product, an efficient taste testing procedure was required.

Such a taste test panel procedure was devised and proved effective in detecting commercially important flavor changes when they did occur, and what is equally important, in indicating the formulations and levels of pesticides which may be used safely without causing objectionable flavor changes.

The procedure employs 8 to 10 carefully tested individuals whose sensitivity to these flavor changes has been demonstrated statistically. Each pesticide is then applied to a minimum of 5 different crops, for a minimum of 20 separate tests. If no off flavor is detected, the pesticide is cleared for general use. If in seven or more of the tests, some off flavor is detected by the panel, the pesticide is labelled as not satisfactory. If some off flavor is detected, but in less than seven of the twenty tests, additional work is indicated.

(Project QH-58-o)

POULTRY

The ultimate goal of all research in agriculture is to enable man to produce food, clothing, and shelter more efficiently. In animal agriculture, we are most concerned with producing the greatest number of pounds of meat per pound of feed fed to the animals. Research in poultry is directed toward that goal, yet we find that it is often necessary to uncover more fundamental facts before direct application of known facts can be made. All phases of the research programs must advance simultaneously since the geneticist, for example, is continually breeding better animals and the nutritionist must then find the best ways to feed the improved animals. At the same time, the experts in the field of technology must continually improve methods of preparing the animal products for the consumer. Poultry products are in direct competition with all other food products for consumer acceptance, and for that reason must be produced efficiently if the industry is to be successful.

Different Fats Compared in Broiler Rations

Comparisons of the feeding value of three different fats (stabilized tallow, Titer 41; stabilized yellow grease, Titer 37; and hydrolyzed animal and vegetable fat) and a mixture of vegetable oils were compared in broiler rations at levels of 2 and 10 percent in both pelleted and mash feeds. No differences were observed between the various fats employed in either growth rate or feed conversion. The rations containing the higher level of fat showed better feed

conversions due to the higher nutrient potency. In this work, the level of supporting nutrients was maintained in balance with the total energy level.

In other studies with broilers maintained in batteries, fat levels as high as 40 and 50 percent were tolerated with excellent results as long as the nutrient balance was properly maintained.

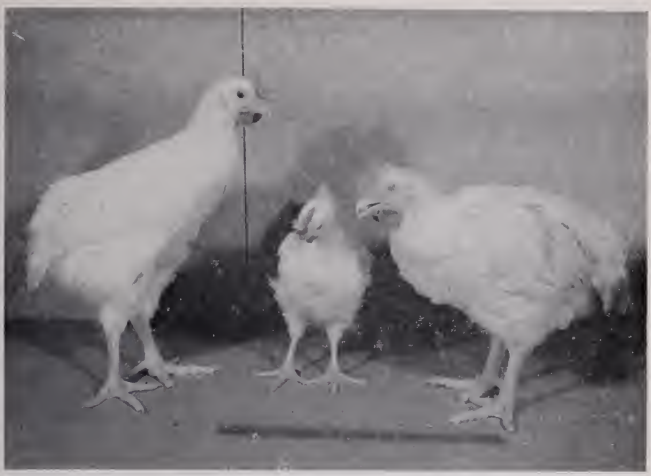
(Project M-35-l)

New Records Set with High Efficiency Feeds

In collaborative work with Dr. C. D. Caskey, Cooperative Mills, Baltimore, using extremely high potency formulas, record feed conversions were obtained. These feeds contained high levels of fat and other supportive nutrients required to maintain proper nutrient balance. Rapid growing male chicks were used (Vantress x Arbor Acre and Vantress x Nichols 108). Pens of broilers averaged 3 lbs. in as little as 44 days. Also some of the formulas gave extremely good feed conversions with one group averaging as little as 1.04 pounds of feed per pound of chicken at 3-pound weights. Other feed conversions of 1.07, 1.10, 1.11, 1.15, etc. were obtained. One formula, which was composed of only practical ingredients, had a feed conversion of 1.19. The experimental high efficiency formulas gave appreciably better feed conversions and slightly more rapid growth than did a practical commercial broiler feed control. Figures 1, 2, and 3 reveal the differences in size of birds obtained with a modified 1912 formula, the 1958 practical commercial broiler ration, and the 1958 special experimental feed.

(Project M-35-l)

Effect of different feeds on live and dressed weights of crossbred male broilers. Top: modified 1912 feed produced dressed eviscerated broilers which averaged only 0.71 lb. at 44 days of age. This group reached 3 lb. average live weights after 78 days. Middle: 1958 commercial broiler ration produced dressed eviscerated carcasses which averaged 1.78 lbs. at 44 days of age. These reached 3 lb. average live weights at 49 days. Bottom: 1958 special experimental feeds produced dressed eviscerated birds which averaged 2.16 lbs. at 44 days of age. At that time, they averaged 3 lbs. live weight.



Here's graphic proof of nutritional progress. The bird on the left was fed a 1958 commercial broiler feed — weight at 44 days, 2.62 lbs. The center one received a modified 1912 feed, and weighed only 1.14 lbs. at 44 days. The heavy bird on the right was fed a special 1958 experimental ration. It weighed 3.02 lbs. at 44 days of age. All weights represent pen averages.

Study Feeding Value of Hydrolyzed Poultry Feathers

Broiler studies were conducted under practical conditions with rations containing up to 2½ percent hydrolyzed poultry feathers. Control rations, in which the protein was replaced by soybean meal, poultry by-products meal, or fish meal performed equally well. These rations had C/P ratios of approximately 42:1 in the starting feeds and 50:1 in the finisher feeds. Under such conditions, hydrolyzed poultry feathers may be used to supply a portion of the protein with no adverse effects.

In other studies involving methionine-low rations, hydrolyzed poultry feathers were added at different levels to determine whether or not its high cystine content might exert a sparing effect on the methionine requirement. This did not occur. In fact, a slight growth depression was observed when hydrolyzed poultry feathers were added to the methionine-low basal, and this was completely corrected when supplemental methionine was added.

(Project M-35-1)

Dietary Methionine and Choline Levels Related

Three studies with broilers have shown that the dietary need for methionine is spared slightly by the addition of supplemental choline. The reverse was also found to be true. The basal ration, which contained 10 percent fat and 700 mg. choline per pound, responded to either methionine or to additional choline. However, rations which contained sufficient added methionine failed to respond to additional choline and rations which contained

900 mg. choline per pound failed to respond to additional methionine. The methionine level in these starting rations amounted to approximately 1.93 grams of methionine per therm of productive energy.

(Project M-35-i)

High Fat Rations Increase Egg Size

White Leghorn hens receiving diets containing 10 percent added fat (either corn oil or stabilized animal tallow, Titer 41) laid eggs which were significantly heavier than eggs produced by controls receiving rations not containing added fat. Similar results were obtained last year when a different fat (hydrolyzed animal and vegetable fat) was used, also at the 10 percent level. The greatest effect on egg size, however, was observed when the corn oil was the source of added fat.

(Project M-35-m)

Protein Quality Affects Level of Protein Required

Using a practical-type broiler ration with a C/P ratio of 42:1 (42 calories productive energy per pound of feed for each percent of protein in the ration), the protein level was further reduced by replacing a portion of the soybean meal with ground yellow corn. This lower protein ration then was supplemented with the amino acids, methionine and glycine, at various levels. Thus, broiler starting rations with calorie-protein ratios of 46:1 (by assay) were able to support comparable rates of growth with similar feed conversions. This lower protein ration responded to methionine supplementation. By improving the amino acid make-up or "quality" of the ration, the level of protein required in the ration may be reduced.

(Project M-35-i)

Poultry Zinc Requirement Shown

In studies with both turkeys and chickens involving purified-type diets, zinc has been shown to be required for rapid growth, normal bone development, and proper feather formation. Similar studies with laying hens indicate that zinc is essential for hatchability of fertile eggs, and for maintenance of normal eggshell thickness.

Studies with laying hens and broiler chickens have failed to show a response to the addition of supplemental zinc when practical-type rations were used. In one test with turkey broilers, however, a growth response was obtained from the addition of zinc to two different practical turkey starting rations.

In addition to the critical role of zinc, higher levels of potassium have been found to be required by the rapidly growing poult than was heretofore considered necessary. It appears that the need for additional zinc and potassium may explain partially the response to "unidentified growth factor" supplements for turkeys.

(Project M-35-g)

Unidentified "Ash Factor" Required

Rapidly growing poults during the first two weeks respond to the addition of inorganic ash of distiller solubles. This growth response amounts to approximately 8 to 10 percent even though those minerals recently shown to be of critical importance (molybdenum, selenium, zinc, potassium, boron, and bromine) are included in the diet. This response is comparable to that obtained from the unashed distillers solubles, or from combinations such as fish solubles and dried brewers yeast. Studies will be undertaken to identify this mineral component.

(Project M-35-g)

Antibiotics Tested Under Germ-Free Conditions

Work carried out in collaboration with Dr. Martin Forbes, of the Walter Reed Army Medical Center, has shown that young poults reared in a germ-free environment do not respond to orally administered antibiotics (either procaine penicillin G. or oleandomycin). These same antibiotics stimulated growth significantly, however, when the poults were reared under conventional (non-germ-free) environmental conditions. This work relates the antibiotic response to the presence of bacteria.

(Project M-47)

Antibiotic Dips Preserve Egg Quality

The storage of market eggs has long constituted a major problem, since the product is quite perishable. Microorganisms are the most common cause of spoilage, as they enter the egg through the pores in the shell and find an adaptable media for growth in the egg content. Chlortetracycline is known to be effective against many microorganisms, and it was studied as a means to prevent egg spoilage.

Studies were performed to determine the degree of penetration of chlortetracycline through the shell of the egg. It was found that chlortetracycline at different concentrations ranging from 125 to 1000 p.p.m. was recoverable in the albumen of the egg but not in the yolk. At the higher level of 1000 p.p.m., the range of chlortetracycline recovered was from .006 to 0.32 micrograms per gram of albumen.

Preliminary studies were performed with unwashed eggs dipped in solutions containing 20 p.p.m. of chlortetracycline. After 21 days of storage under commercial conditions, approximately 80 percent of the untreated eggs and 2 percent of the treated eggs in the experiment showed fluorescence when the interior portion of the shell was exposed to ultra-violet light. When 50 p.p.m. chlortetracycline was used, no fluorescence was observed in the treated eggs whereas 30 percent of the eggs in the untreated samples were fluorescent.

These preliminary findings indicate that shell eggs may be successfully treated with antibiotics.

(Project M-46)

Study Composition Detection of Meat Spots in Eggs

Meat spots continue to be a problem in brown eggs. In white eggs, the problem is not so acute because they are light in color and they go unnoticed by the customers. As far as is known, meat spots are not injurious if they are eaten but consumers object to seeing these abnormal inclusions in eggs. These spots cannot be detected by automatic equipment that takes out blood spots.

The composition of these spots has been studied more closely. At least some of the spots have a high percentage of calcium in them, and the base material consists mainly of protein. At least 11 chromatographic entities are present in the amino acid composition of this protein. Tests for fat indicate that no fat is present. Therefore, if fat is not present it is concluded that the source of these spots is not egg yolk as egg yolk contains considerable amounts of fat.

All of the flocks presently on the University Farm have been surveyed for spot incidence. The incidence runs from a low of 11 percent to a high of 66 percent in some flocks. Hens on various experimental diets have been checked for incidence. Fat (vegetable or animal), zinc, choline or C/P ratio do not have an effect on the incidence. An attempt was made to detect these spots fluoroscopically, but at least with the methods used no spots can be detected in the intact egg.

(Project M-51)

Study Effect of High Ambient Temperature on Eggshell Thickness

During periods of high ambient temperatures, there is a drop in the shell thickness of eggs which causes a huge economic loss in market channels. A working hypothesis that during high ambient temperatures there is a considerable loss of CO_2 due to hyperventilation was tested. It was observed that during high temperatures there was a significant rise in the blood pH which supports this hypothesis. However, by feeding acidifying salts to lower the blood pH the ill effects on shell thickness could not be reversed.

Several interesting observations were noted from these experiments. It was observed that there was a significant correlation between shell thickness and blood pH; that is, the higher the blood pH the thicker the shells were. It was possible that this method could be used to check hens for good shell quality in a breeding program. Another observation which has considerable significance was that by feeding acidifying salts the number of AA quality eggs could be increased by as much as 50 percent. Up to this time, conclusive evidence has not been presented that diet can influence albumen quality. This gives us a good starting point to determine the differences between high and low quality eggs, mainly in the interests of basic research. It could also be of practical significance.

(Project M-53)

Study Quality Retention in Poultry Meats

A great deal of machinery and manpower are expended in feather removal. It has been demonstrated that the more mechanical beating poultry has been exposed to, the tougher the meat gets. Also, high scald temperatures which will facilitate better feather removal will cause the flesh to be tougher.

Some preliminary observations on this project, which has just been initiated, indicate that timing between the killing and scalding and between the scalding and the time of picking are important to gain the maximum ease in feather removal. Further work is being conducted in this area, along with different killing procedures. CO_2 and other anesthetizing agents will be used to make the bird insensible before killing. This phase has been added because of the probability of legislation in more humane methods of slaughter.

(Project M-100)

Protozoa Provide New Tool for Nutritional Research

Protozoa are single-celled animals having nutritional requirements similar in many respects to higher animals. These single-celled animals can be easily studied under controlled and sterile nutritional conditions. A protozoa from pigeons, *Trichomonas gallinae*, requires cholesterol and has been found here also to require a saturated and an unsaturated fatty acid for growth. This same organism also requires at least two other unidentified factors.

This protozoa is being used in intermediate studies of lipid metabolism, a field in which there is much interest at present, both in the poultry feed industry and in human heart diseases. Little is known about the specific or intermediate functions of the different fatty acids and other lipoid compounds for growth, cholesterol transport and deposit, and in other metabolic processes.

(Project M-48)

Vitamin B_{12} Inhibitor Affects Embryo Development

Chick embryos and protozoa have been used in fundamental research studies in nutrition and growth processes. Compounds chemically related to

vitamin B_{12} have been studied for their effect on chick embryo development. While many of the compounds were lethal and produced more or less characteristic malformations, one compound (1,2-dichloro-4,5-diaminobenzene, an inhibitor of vitamin B_{12} and riboflavin syntheses in microorganisms) specifically caused a type of malformation which has never before been reported. It prevents the development of the trunk region below the heart while allowing the head region above the heart to develop normally.

It is believed that this compound will be very useful for learning about the little known chemical processes underlying differentiation (the development of different types of tissues) and the organized manner in which animals develop from a single cell.

(Project M-49)

Begin Study of Serum Cholesterol Level

Cholesterol is a compound of considerable importance in the metabolism of the chicken, but it is not known what effect, if any, different levels of cholesterol in the blood have on egg production, egg quality, and so forth of the chicken.

An experiment has been started to investigate this by (1) statistical methods, and (2) genetic methods. It has been possible to develop high and low lines, differing markedly in their cholesterol level. The performance of these lines in the laying house will soon be tested to find out the effect of different cholesterol levels.

Although in a genetic study such as this it takes years to obtain results, some preliminary observations can now be made. There does not appear to be any consistent relationship between cholesterol level and body weight, sexual maturity, egg production, egg weight, and shell thickness. There is apparently a negative relationship between cholesterol and albumen quality in the fall, but not in the spring. Hatchability of eggs in both cholesterol lines has been very poor, particularly in the high line.

(Project M-33-e)

Develop New Productive Strain of Turkeys

By and large, present-day strains of turkeys do not reproduce very satisfactorily, a factor which adds considerably to the cost of producing turkeys. One has only to refer to the data from some of the random sample turkey tests to verify the above statement. The data from the Fifth Annual Texas Central Random Sample Turkey Test show that the Broad-Breasted Bronze hatched only slightly better than 50 percent of all eggs set, while the hatchability of the eggs from the white birds entered averaged 56 percent. Even these figures are somewhat higher than they would be if artificial insemination were not practiced on some of the flocks.

A strain of birds, the Maryland Medium White, has been developed at the University of Maryland. This strain has good reproductive performance in that hatches of 80 percent of all eggs set are experienced even though all birds are naturally mated. The mature birds are much larger than the Beltsville Whites, but not quite as large as the Broad-Breasted Bronze. They have been selected for good viability and the ability to withstand confinement rearing. The birds have been distributed to some commercial breeders.

(Project M-34-e)

Study Relationship Between Egg Production and Molt

Man has since earliest times observed that birds normally replace their feathers at least once a year, and that seldom do birds molt and lay simultaneously. This latter factor, then, makes molt an economic consideration for the poultryman. Studies have been under way to determine the physiological cause of molt and to determine if molt can be induced at unnatural periods of the year, or if molt can be prevented. Observations have indicated that the hormone, luteotropin, produced by the anterior pituitary gland may well be involved in this phenomenon. Luteotropin affects the activity of the ovary and is thought in most animals to cause the production of progesterone, a hormone which has been shown to be effective in initiating molt. Several hormones with progestational activity were screened and found to be effective in varying degrees in initiating molt. These compounds were found to be effective on capons as well as hens, indicating that the gonad is not necessarily the prime causer of response.

(Project M-32-l)

Test Effect of Temperature Changes on Egg Production

The effect of the rate at which temperature changes has been studied vary little in respect to egg production and quality. Experiments have been conducted on this in hot and cold control rooms with cage layers.

Comparisons were made of the effect of rapid (4°F./hr.) versus slow (5°F./day) rises in temperature to 100° F. There was little difference between the two rates, but there was a tendency for a greater effect with the quick rises. At both rates of temperature rise, there was a pronounced decrease in shell thickness, egg weight, and feed consumption and a pronounced increase in albumen height.

Comparisons were also made of the effect of rapid (2° F./hr.) versus slow (½° F./hr.) drops in temperature to 10° F. There was little difference between the two rates, but there was a tendency for a greater effect with the fast drops.

At both rates of temperature decline, egg production and shell thickness were reduced, feed consumption was greatly reduced, and albumen quality and egg weight were not affected. Frozen combs presented a serious problem, particularly with White Leghorns at the rapid decline in temperature.

Results of these experiments should be useful in future design of poultry houses, both for floor and cage layers.

(Project M-50)

Study Fertility of Chickens and Turkeys

Fundamental studies have been conducted on the effect of various conditions on the fertilizing ability of chicken semen. These results should prove valuable in designing methods for a much wider usage of artificial insemination than is now practicable.

In studies in which semen was diluted at different rates, the fertility was reduced when the dilution rate was greater than 1:3. There was some improvement in fertility when semen was concentrated by centrifugation. A number of antibiotics were tested for their effect on motility, bacterial count, and fertility. The combination of terramycin and dihydrostreptomycin was found to improve fertility from semen stored for one day. The number of bacteria in semen was found to be very great, which further emphasizes the importance of controlling bacteria with anti-

biotics.

Several different methods of handling chicken semen during storage have been tried. Some of the methods used were considerably better than previously tried methods. Of all methods, the best one was that in which semen was diluted 1:10 with a buffer containing antibiotics, stored at 10° C., and then brought to its original concentration just before insemination. Further improvement was obtained by the addition of fructose at the end. Using this method, fertility in excess of 70 percent was obtained in most cases with a storage period of 24 hours. Furthermore, this has made possible the first successful shipment of semen overseas (to Israel).

(Project M-33-j)

Check Relationship of Alkaline Phosphatase to Egg Production

Experiments are under way to determine the relationship between the alkaline phosphatase level of the blood serum of the young chicken and its subsequent egg production. In addition, evidence on the genetics of alkaline phosphatase is also being sought.

Although it takes many years to obtain results on a breeding project such as this, some preliminary observations can now be made. Apparently there is a positive relationship between alkaline phosphatase level of the blood and egg production but not egg quality, body weight, and sexual maturity.

Definite genetic differences between hens in their alkaline phosphatase level have been established, and after one year of selection, a high line for alkaline phosphatase has been delineated. It is hoped that by this method it will be possible to determine if egg production can be increased by breeding for high alkaline phosphatase concentration.

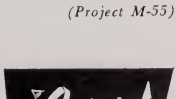
(Project M-32-m)

Study Color Preference of Layers

It is known that chickens can see colors about the same as man, although they are much less sensitive to blues and violet. Almost nothing is known of their color preference, however. A study was conducted to ascertain if a new, plastic nesting material could replace shavings, and the material was provided in colors to measure color preference. The preferred colors were light red and light blue, black, and light grey. Yellow and tan were generall not preferred. In more or less of an intermediate position were green, dark red, orange, brown and dark blue. The plastic nesting material was successful from the standpoint of cost of material, cost of servicing nests, number of floor eggs, and number of cracked eggs, but we encountered a serious increase in the number of dirty eggs produced.

(Project M-55)

RURAL SOCIOLOGY



During the 1957-58 year, research in rural sociology developed in new directions. Because of these developments, this is a progress report rather than a report of final accomplishment.

Participate in Regional Population Research

During this fiscal year Maryland continued to serve as a central data processing station for the Northeastern states in verifying individual State migration tabulations and compiling these into division and region distributions. Drafting of two reports on regional population approached completion. One report deals with the region's population composition and characteristics over the past half century and the other report deals with migration and metropolitan-non-metropolitan county's characteristics.

The second report will elucidate on population characteristics by derived residence categories. To cite briefly two conclusions: We may now speak with assurance that suburban residents (urban fringe) in much of the Northeast have high education and income attributes and follow occupations associated with these. Despite the great number of children in urban-fringe areas the typical breadwinners and active homemakers of this kind of area do not support large populations of financially dependent persons (less than 15 years of age and 65 years of age or older) when compared to rural populations.

In addition, this past year was the period when a Delaware population report was completed by this station. Cooperative work of this nature increases the store of knowledge concerning the region and bears research reports for those states whose station's staff does not include demographers.

(Project S-3-2)

Rural Development Research Underway

Another project for which preliminary conclusions may be cited is the Calvert County study done within the context of Rural Development. The survey data indicate that this county's residents have intensified their educational training since 1950 (some of this is due to in-migrants' educational characteristics), that average incomes have advanced dramatically, that governments provide a substantial employment source for residents, and that this county, like many counties whose residents have an interest in development efforts, exports many of its young educated people to take jobs in other places.

(Project S-5)

VETERINARY SCIENCE

This Department now is charged with teaching and research, in addition to service. Some staff members devote all of their time to research; some combine research and teaching; and others combine research with diagnostic activities in the Live Stock Sanitary Service.

In addition to the research projects which are reported herewith, there are programs for graduate students, all basically in the field of animal and poultry diseases. Most of these are fundamental in nature. In general, the research projects chosen by the Department are of a practical nature.

Continue Investigations on Brucellosis

Much valuable information has been obtained, concerning immunity of cattle to brucellosis, through the measurement of the protective ability of blood sera in preventing death in infected embryonating eggs. More than 2,000 cattle sera have been tested and a tentative standard has been set up with which to compare individual samples of blood sera and make comparative tests. Such information will be most useful in evaluating vaccination and in planning for future brucellosis control.

The present Strain 19 *Brucella abortus* vaccine appears to be quite satisfactory for calfhood vaccination, but it produces persistent agglutination titers when used in adult animals. An acceptable vaccine for mature cattle should not only bolster immunity of already vaccinated animals or stimulate the production of immune bodies to such an extent that the animal is resistant to the disease, but it should not cause the development of long lasting agglutination titers to confuse the diagnostic picture. A killed Brucella strain, an embryonating egg-adapted form, and a streptomycin dependent organism, all show some promise of fulfilling the conditions for such a vaccine and will be tested further.

Experimental studies on brucellosis vaccination have been continued for more than 15 years at this and other stations and have greatly contributed to the eradication program now rapidly drawing to a close.

(Project D-50)

Continue Studies with Newcastle Disease

Investigational work has been conducted with a view to obtaining further information about the hemagglutination-inhibition test, which is one of the methods employed in the laboratory to diagnose Newcastle disease. Inoculation of month-old chickens with systematically arranged suspensions of sedimented Newcastle virus and supernatant fluid indicates that the larger virus particles are concerned in the formation of hemagglutination-inhibiting antibodies in the blood of chickens.

Certain difficulties have been encountered in immunizing poultry flocks against Newcastle disease with live-virus vaccines. For this reason, experimental work has been conducted to investigate the value of innocuous immunizing agents. In the beginning, tests were carried out with Newcastle-immune blood serum salvaged from a slaughter house. Immune serum was found to give good protection against artificial exposure to disease with moderately large doses of virus (1,000 ELD_{50}) administered simultaneously. Serum administered 24 hours after exposure was less effective and completely lacking in value when administered 48 hours after exposure to Newcastle. Immune serum prepared in mammals (rabbits) was as effective as serum prepared in chickens. The most effective dose of serum employed for 6-week-old chickens (4 mls.) was only partially effective against larger doses of virus. The protective value of Newcastle-immune serum lasted for more than 2 weeks which was the longest period tested.

(Project D-52)

Study Epizootiology of Equine Encephalitis

Although there were no cases of equine encephalitis reported in Maryland in 1957, a significant number of horses and ponies were shown to have antibodies in their blood following the 1956 outbreak. These findings suggest that animals, and possibly other vertebrates, can become infected with the virus of equine encephalitis without developing recognizable disease. Such individuals are probably immune as a result of infection which may account,

in part, for the cyclic occurrence of epidemics.

In a cooperative effort with the Entomology Department, attempts were made to detect equine encephalitis virus in salt-marsh mosquitoes in the summer of 1957. No virus isolations were made.

A hemagglutination-inhibition test has been developed for eastern equine encephalitis that enables a rapid diagnosis of the disease and is a useful aid in research and epidemiological studies.

(Project D-57)

Develop Simple Test for Bovine Mastitis

Mastitis, or inflammation of the udder, may be associated with clotted, stringy, or flaky milk. However, for each visibly diseased quarter in any herd, five to six exist "unseen." In order to decrease the infection, "unseen" mastitis must be treated. Detection is possible only through bacteriological testing of milk from individual quarters.

A "direct tube method" of culture, designed and tested in the Department of Veterinary Science, is being used for this purpose. Fore-milk is inoculated directly into one-half ounce square bottles which contain two layers of agar media on opposite sides. After 24 hours in the incubator, over 98 percent of the species of bacteria that cause mastitis may be detected without complicated handling of individual colonies.

From the types of organisms found in a 1957 survey of 126 herds, it is estimated that 40 to 50 percent of all cases of mastitis could be eliminated by testing and treating, along with improving sanitation and milking procedure. Mastitis control is helpful to individual dairymen for the prevention of disease and improvement of milk quality.

(Project D-58)

Several Organisms May Cause Air-Sac Disease

The bacterial flora inhabiting the respiratory system of turkeys was found to be similar to that of chickens. Air-sacs of healthy chickens and turkeys usually were found to be free from microorganisms. (Air-sacs are delicate pouches adjoining the lungs and peculiar to the bird family.)

Inoculation of germ-free turkeys hatched and reared in special "tanks" has shown that germs commonly designated pleuropneumonia-like-organisms (PPLO) are capable of causing severe inflamation of the air-sacs. Such organisms have been found to be free from any associated virus that could exert a similar affect in the tissues of the bird.

Other inoculation studies with pleuropneumonia-like-organisms revealed that later in the course of the disease, PPLO often are joined by other bacterial organisms called "secondary invaders". Further experiments are in progress to determine what effect such secondary invading bacteria exert upon the initial infection.

Bacteriological examination of naturally occurring cases of air-sac disease has shown PPLO to be present in most cases. Associated with them, however, are such other bacterial organisms as *E. coli, Ps. aeruginosa* and the fungus, *A. fumigatus.* Also it has been shown that certain viruses are capable of causing air-sac disease.

Air-sac disease in domestic poultry, therefore, on the basis of present information, is regarded as an ailment in which several different microorganisms may be concerned.

(Project D-59)

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H. M. DeVoll, D.V.M., M.S., Prof. Path.
R. L. Regan, Prof. Vet. Virology
J. R. Sperry, D.V.M., Assoc. Prof. Vet. Sc.

CHANGES IN PERSONNEL
Appointments
Robert J. Beiter, M.S., Instructor, Agricultural Economics, July 1, 1957
Richard D. Creek, Ph.D., Assistant Professor, Poultry Husbandry, January 1, 1958
Roger W. Hemken, Ph.D., Assistant Professor, Dairy Husbandry, August 1, 1957
Francis G. Hueter, Ph.D., Research Assistant, Dairy Husbandry, January 16, 1958
Herman A. Hunter, M.S., Assistant Professor, Agricultural Economics, February 10, 1958
Jack C. Jones, Ph.D., Associate Professor, Entomology, March 1, 1958
James R. Miller, Ph.D., Assistant Professor, Agronomy, May 1, 1958
Gray N. Nuckols, B.S., Instructor, Agricultural Economics, September 1, 1957
Resignations
Frank L. Bentz, Ph.D., Associate Professor, Agronomy, March 16, 1958
George L. Romoser, Ph.D., Assistant Professor, Poultry Husbandry, October 31, 1957

FINANCIAL STATEMENT — July 1, 1957 to June 30, 1958

	Federal Funds			
	Amended Hatch	*Regional Research*	*Agr. Marketing Title II*	
Appropriation 1957-1958	$ 334,282.00	$ 89,680.00	$ 2,511.40 7,000.00	
Totals	334,282.00		9,511.40	
Receipts from sources other than Federal 1957-58				*For Agr. Investigations**
State Appropriations for Agricultural Investigations				$ 826,286.58
Special Endowments, Fellowships and Grants				45,424.64
Sales and Miscellaneous				161,183.80
				1,032,895.02
Balance brought forward July 1, 1957				112,467.41
Total				1,145,362.43
Expenditures:				
Personal Services	218,390.31	57,851.51	5,471.38	694,865.67
Travel	5,147.34	2,158.88	771.60	12,430.09
Transportation	259.10	41.39	.....	920.19
Communication Service	555.09	197.37	22.58	3,605.16
Rents and Utility Services	1,859.31	745.28	.....	14,625.73
Printing and Reproduction	6,112.51	298.31	.....	4,421.63
Other Contractual Services	7,738.95	4,626.75	6.00	50,632.86
Supplies and Materials	56,286.56	11,834.75	207.04	241,865.64
Equipment	26,916.53	11,925.76	375.73	38,283.66
Lands and Structures	150.00	.....	.....	1,651.27
Contributions to Retirement	.....	.....	.....	.....
Taxes and Assessments	.....	.....	.....	1,337.42
	323,415.70	89,680.00	6,854.33	1,064,639.32
Balance June 30, 1958	10,866.30	.....	2,657.07	80,723.11
Totals	334,282.00	89,680.00	9,511.40	1,145,362.43

* Including Offset Funds

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Department of Horticulture

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Department of Poultry

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Department of Veterinary Science

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Miscellaneous

304 A Statistical Evaluation of the Reliability of Some Hunter Bag Check Data. Vincent Schultz. Multigraphed Circular 43 pp. January 1958.

PROJECTS

(These are projects and not publications available to the public)

Department of Agricultural Economics and Marketing

A-18-ak Organization and Operation of Maryland Tobacco Farms. R. A. Murray and K. N. Adams

A-18-al An Economic Study of Maryland Dairy Farms. J. W. Wysong.

A-18-am An Analysis of Alternative Adjustments in Farm Organization. Sidney Ishee and G. N. Nuckols, Jr.

A-19-o Conservation and Economy in Rural School Bus Transportation. S. H. DeVault, W. P. Walker and L. C. Biser.

A-19-p Factors Affecting the Cost of Certain Kinds of Insurance to Farmers. W. P. Walker and Sidney Ishee.

A-19-r Impact of Maryland Highway Improvement Program on Agriculture. W. P. Walker, F. E. Hulse and J. H. Dagher.

A-19-s Effects of Maryland Tax System and Fiscal Policy on Farmers Tax Liability. P. E. Nystrom, W. P. Walker and F. E. Hulse.

A-19-t Capital Requirements in Agriculture. P. R. Poffenberger and Sidney Ishee.

A-19-u The Effects of Property Tax Assessment and Exemption Practices on Maryland Farmers and on State Aid Equalization Programs. W. P. Walker, Sidney Ishee and R. S. Poffenberger.

A-19-v An Analysis of the Distribution of Highway User Taxes for Rural and Urban Highways in Maryland. W. P. Walker.

A-26-ah Marketing Maryland Forest Products. G. M. Beal and B. R. Robertson.

A-26-al Analysis of the Development of Farmer Cooperatives. P. R. Poffenberger and R. J. Beiter.

A-26-am Alternative Merchandising and Promotional Methods Affecting Demand for Poultry Meat. H. D. Smith, R. J. Beiter and graduate assistant.

A-26-an Relation of Various Livestock Marketing Methods to Producer Returns. H. D. Smith and J. N. Smith

A-26-ao Quality and Volume Effects Upon Economies of Plant Operation in the Canning of Tomatoes, Corn and Peas in Maryland. D. J. Burns, E. N. Gogel, F. D. Gray and Sidney Ishee.

A-26-ap Supplies and Utilization of Milk for Non-Fluid Uses in the Washington, D. C., Milkshed. G. M. Beal, A. D. Jeffrey and P. R. Poffenberger.

A-26-aq Marketing Maryland Snap Beans. G. M. Beal, Cabell Shull and L. C. O'Day.

A-26-at A Study of Egg Marketing in Maryland. H. D. Smith and R. J. Beiter.

A-26-au Marketing of Maryland Sweet Potatoes. H. D. Smith, R. F. Voelkel and graduate assistant.

A-26-av Marketing Margins as Associated with Expansion or Curtailment in Consumer Services. S. C. Shull, C. C. Taylor, Joseph Dagher and Bhagwant Singh.

A-26-aw Pooling Arrangements and Quota Plans in Maryland Fluid Milk Market. G. M. Beal and K. N. Adams

A-26-ax Market Outlets and Methods of Marketing Chickens and Turkeys from Farm Flocks. H. D. Smith, R. J. Beiter and L. H. Davis.

A-26-ay Improving Techniques of Market Preparation and Grading of Maryland Tobacco. G. M. Beal and Ray Voelkel.

A-32-f Farm Tenancy and Leasing Arrangements in Maryland. Sidney Ishee.

A-32-h Effect of Drainage Upon Crop Yields, Farming Practices and Land Utilization. Sidney Ishee.

A-32-j Problems Associated with Farm Irrigation in Maryland. Sidney Ishee and Robert Hamby.

A-34 Economics of Scale and Factors Affecting Variations in Cost of Processing Fruits and Vegetables in Maryland. L. C. O'Day.

A-35 Buying Practices of Fruit and Vegetable Processors. G. M. Beal, Wayne Bitting and H. P. Stutts.

Department of Agricultural Education

T-4 The Role of Educational Campaigns in Removing Hazards from Farms. H. P. Hopkins and A. M. Ahalt.

T-5 Improving Agricultural Community Shows and Exhibits. A. M. Ahalt and H. P. Hopkins.

Department of Agricultural Engineering

R-11-d Tobacco Housing. P. N. Winn, G. J. Burkhardt, E. W. Martin, O. E. Street and C. G. McKee.

R-11-e Structures and Equipment for Tobacco Stripping. P. N. Winn, G. J. Burkhardt, E. W. Martin, O. E. Street and C. G. McKee.

R-16 Pneumatic Handling of Chopped Forage. G. J. Burkhardt, A. V. Krewatch, K. E. Felton, E. W. Martin and J. E. Foster.

R-17 Drying Shelled Corn with Unheated Air in Maryland. G. J. Burkhardt and E. W. Martin.

R-18 Development of Equipment and Improved Methods for Harvesting Sweet Potatoes. G. J. Burkhardt and E. W. Martin.

Department of Agronomy

B-43 Soybean Culture and Varietal Improvement. R. C. Leffel and W. D. Hanson.

B-50 Breeding for Better Dent Corn. R. G. Rothgeb and staff members.

B-56-a Red Clover Improvement. R. C. Leffel and A. M. Decker, Jr.

B-56-g Ladino Clover Breeding. R. C. Leffel and A. M. Decker, Jr.

B-56-i Breeding Orchard Grass for Maryland. R. C. Leffel and A. M. Decker, Jr.

B-56-j Pasture Species for Beef Production. A. M .Decker, Jr., and J. E. Foster.

B-56-l Variety and Strain Testing of Forage Legumes and Grasses in Maryland. R. C. Leffel and A. M. Decker, Jr.

B-56-m Seedling Establishment and Management of Legumes and Grasses. A. M. Decker, Jr., and N. A. Clark.

B-56-n Alfalfa and Alfalfa-Orchard Grass Management. A. M. Decker, Jr.

B-56-o Management and Fertilization of Established Grass and Grass-Legume Mixtures. A. M. Decker, Jr.

B-58-c Weed Control in Legumes. J. A. Meade, T. L. Bissell and W. C. Hurlburt.

B-58-d Influence of Environmental Factors on the Effectiveness of Several Carbamate Herbicides. J. A. Meade, P. W. Santelmann and A. O. Kuhn.

B-58-e The Use of Chemical and Cultural Methods to Control Weeds in Field Crop or Turf Areas. P. W. Santelmann and J. A. Meade.

B-60 Tobacco Fertilizer Rates and Placement in Relation to Plant Population. O. E. Street, C. G. McKee, J. E. McMurtrey, Jr., and G. A. Bourbeau.

B-66 Wheat Improvement for Maryland. R. G. Rothgeb, J. L. Newcomer and J. H. Axley.

B-67 Improvement of Small Grains for Feed. R. G. Rothgeb and staff assistants.

B-68 Effect of Rotational Practices Involving Various Legumes on the Growth, Quality and Composition of the Maryland Tobacco. O. E. Street, C. G. McKee, B. L. Grove, C. S. Britt, C. S. Slater and L. B. Nelson.

B-69 Breeding for Mildew Resistance in Winter Barley and Wheat. R. G. Rothgeb and M. M. Cohen.

B-71 Performance of Grain Sorghum Hybrids in Maryland. R. G. Rothgeb and staff assistants.

BOQR-84 Climatological Relationships to Plant Growth Employing Supplemental Irrigation. (In cooperation with Department of Agricultural Engineering and Horticulture). O. E. Street, A. M. Decker, Jr., R. E. Wagner, E. Strickling, C. W. Reynolds, P. W. Winn, L. D. Nelson, H. H. Engelbrecht and M. L. Blanc.

N-10 Inspection and Examination of Seeds Produced or Sold in Maryland. J. L. Newcomer, M. H. Day, O. M. Kelk. E. P. Emack, A. H. Ferguson and L. R. Downey.

O-48 Classification and Correlation of Maryland Soils with Special Emphasis on Morphology, Fertility and Conservation and Interdependence of These Factors. G. A. Bourbeau and Michael Redgrave.

O-51 Alfalfa Fertilizer Practices. J. H. Axley

O-54 Mineralogical Studies of Maryland Soils. G. A. Bourbeau, M. Bennett, J. Parker and A. Van de Putte.

O-55 Study of Soil Tests to Improve Their Accuracy and Reliability. J. H. Axley.

O-56 Factors Affecting the Formation and Destruction of Soil Aggregates. E. Strickling, R. O. Gifford, Michael Redgrave, O. Cohen, T. Olson and A. W. Conoway.

O-58 Corn Stalk Rot Incidence as Affected by Various Rates of Fertilization. F. L. Bentz, Jr., S. E. Younts.

O-59 Response of Orchardgrass to Various Rates and Ratios of Potassium and Nitrogen Fertilization. S. E. Younts.

O-60 The Effect of Various Rates and Frequencies of Potassium Application on Yield, Persistence and Chemical Composition of Alfalfa and Alfalfa Orchardgrass. S. E. Younts.

O-61 Comparison of the Effect of Several Nitrogen Sources on Yield and Nitrogen Content of Grass Under Field Conditions. S. E. Younts.

Department of Animal Husbandry

C-14 A Study of the Productiveness of Purebred Beef Cattle in Maryland. W. W. Green, J. E. Foster and J. B. Lingle.

C-14-a Effect of Early Weaning on the Duration of Maternal Influences in Beef Calves. W. W. Green, J. E. Foster and W. R. Harvey.

C-14-b Type Classification as an Aid in Selection of Beef Breeding Cattle. W. W. Green and J. E. Foster.

C-14-d Group Versus Individual Feeding of Weaned Beef Calves. John Buric, J. E. Foster, W. W. Green, E. R. Conner and J. R. Sperry.

C-20 The Development of Superior Lines of Swine Based on Crossbred or Purebred Foundations. W. W. Green, J. E. Foster and J. H. Zeller.

C-21 The Effect of Speciric Metabolites Upon Growth Rate and General Condition of Sheep. E. C. Leffel, W. H. Brown, J. E. Foster and J. C. Shaw.

C-23 A Study of the Effects of Protein Level on the Reproductive Performance of Female Swine. F. C. Wingert, W. W. Green and J. E. Foster.

C-24 A Study of the Presence and Control of Internal Parasites in Swine. F. C. Wingert, W. W. Green, J. E. Foster and J. R. Sperry.

C-25 A Study of Rumen Metabolism in Sheep. E. C. Leffel, W. H. Brown, R. J. Komarek, S. Lakshmanan and J. C. Shaw.

C-26 Studies of the Protein and Energy Requirements of Growing-Fattening Swine. F. C. Wingert and J. E. Foster.

C-27 A Study of Growth Promoting Properties of Certain Feed Adjuvants. F. C. Wingert and J. E. Foster.

C-28 A Study of the Effect of the Form in Which Feeds are Fed to Swine. F. C. Wingert and J. E. Foster.

C-29 A Study of the Effects of Method of Feeding and of Different Protein Supplements for Growing-Fattening Swine. F. C. Wingert and J. E. Foster.

C-30 Comparison of Methods for the Diagnosis of Bovine Pregnancy. W. W. Green, H. W. Tavenner, J. E. Foster and J. R. Sperry.

Department of Botany

F-12 The Native Plants of Maryland, Their Occurrence, Distribution and Economic Importance. R. G. Brown.

F-15-b Spontaneous and Induced Multiple Seedlings and Haploids of *Zea Mays Capsicum Frutescens* and Other Economic Plants and Their Use in Plant Breeding. D. T. Morgan, Jr., R. D. Rappleye, F. Campos and J. R. Brennan.

F-16 Cytological and Genetical Studies in Ornamental and Crop Plants. R. D. Rappleye, D. T. Morgan, Peter Semeniuk, Lois Carleton, R. W. Grant and J. R. Brennan.

F-17 Forest Tree Improvement by Chromosome Doubling of Haploid Sporophytes. R. D. Rappleye, D. T. Morgan, R. Grant and L. Carleton.

J-86-a The Nature and Control of Sweet Potato Diseases Occurring in Maryland Including Studies on Significance of Microbiological Antagonism. J. G. Kantzes, C. E. Cox and graduate assistants.

J-91 Evaluation of Fungicides for the Control of Diseases of Vegetable Crops. C. E. Cox, H. D. Sisler, J. G. Kantzes, W. O. Weaver, I. F. Brown and B. W. Coursen.

J-92 Development of Antibiotic Substances for Control of Plant Pathogenic Organisms. C. E. Cox, H. D. Sisler. T. Montie, F. Portie and R. A. Paterson.

J-93 Treatment of Soil and Underground Parts of Plants for the Control of Plant Diseases. O. D. Morgan, W. R. Jenkins, J. G. Kantzes, and J. B. Wilson.

J-95 Development of Improved Strains of Maryland Tobacco Resistant to Diseases. O. D. Morgan, O. E. Street, J. Hoyert, Dr. Heggested and assistants.

J-96 Occurrence, Distribution, Biology and Control of Plant Parasitic Nematodes in Maryland. W. R. Jenkins, R. A. Rohde, B. W. Coursen, O. D. Morgan and J. G. Kantzes.

J-97 Biology and Control of Nematodes Associated with Plant Diseases. W. R. Jenkins, R. A. Rohde and O. D. Morgan.

J-98 Identification, Characterization and Control of Certain Viruses Affecting Economic Plants in Maryland. H. D. Sisler, C. E. Cox, O. D. Morgan, W. H. Miller, F. E. Cooper and G. Patino.

J-99 The Nature and Control of Root Rots Involved in Decline of Boxwood and Other Woody Ornamental Plants in Maryland. J. B. Wilson, W. R. Jenkins and graduate assistants.

K-8-c The Role of Trace Elements in Plant Nutrition. H. G. Gauch, R. W. Krauss, Lewis Dove, Leonard Hare, Martin Mathes, G. Harrison and W. McDonough.

Department of Dairy Husbandry

G-34 Chemical Changes in Milk Fat as Related to the Flavor of the Milk. Mark Keeney, E. A. Day and R. Bassette.

G-35 The Analysis of Dairy Products. Mark Keeney and E. A. Day.

G-37 Ketosis and Parturient Paresis in Dairy Cows. J. C. Shaw, E. C. Leffel, A. C. Chung, W. Ensor and K. R. Mason.

G-38 The Physiology of Milk Secretion. J. C. Shaw and S. Lakshmanan.

G-39 A Study of Factors Affecting the Availability and Utilization of Nutrients in Feeds and Their Influence Upon Body Composition, Growth and Milk Secretion. J. C. Shaw, R. N. Doetsch, R. F. Davis, R. W. Hemken, William Ensor and S. Lakshmanan.

G-40 Influence of High Temperature Heat Treatment on Certain Physical and Chemical Properties of Milk. J. F. Mattick.

G-42 Methods of Processing and Other Factors Affecting the Quality of Ice Cream. E. A. Day, J. F. Mattick and W. S. Arbuckle.

G-43 The Metabolism of Acetate, B-hydroxybutyric Acid, Glucose and Other Carbon Compounds in Lactating Ruminants. J. C. Shaw, S. Lakshmanan, R. D. McCarthy, J. B. Holter and Jeanne McCarthy.

G-46 The Relationship of the Hypophyseal Growth Hormone and of the Pituitary-Adrenal System to the Productive Capacity of Dairy Cattle for Reproduction and Milk Production. J. C. Shaw, A. C. Chung and F. G. Hueter.

G-47 Nutritive Evaluation of Forages. R. W. Hemken, R. F. Davis, A. M. Decker, Jr., and James Smith.

G-48 Flavor Quality of Concentrated Milk Products as a Factor in Milk Utilization and Marketing. Mark Keeney and R. Bassette.

G-50 The Physiology of Mammary Gland Growth and Development and the Initiation and Maintenance of Lactation with Particular Reference to Endocrine Relationships. W. F. Williams.

GC-45 A Study of the Causes and Prevention of Bloat in Ruminants. (Cooperation with Animal Husbandy Department). J. C. Shaw, R. N. Doetsch, E. C. Leffel and S. Lakshmanan.

Department of Entomology

H-29-l Chemical Control of Bean Insects: Evaluation of Commercial Treatments and Investigations of New Insecticides. L. P. Ditman.

H-29-m Chemical Control of Insect Pests of Sweet Corn. F. P. Harrison and L. P. Ditman.

H-35-a Nursery Insects. The Euonymus Scale. W. T. Johnson and W. E. Bickley.

H-35-b Nursery Insects. The Control of Arthropod Pests of Azalea with Systemic Insecticides. W. T. Johnson and W. E. Bickley.

H-40-a Biology and Control of Tobacco Insects. The Tobacco Horn Worm. H. S. McConnell.

H-40-b Biology and Control of the Green Peach Aphid on Tobacco. H. S. McConnell.

H-46-d Studies on the Efficiency of Fixed Boom Low Volume Sprayers. L. P. Ditman, W. E. Bickley, George Burkhardt and C. E. Cox.

H-48 Control of the Codling Moth. W. E. Bickley, Castillo Graham, and E. R. Krestensen.

H-56 Patuxent Projects on the Effect of Soil Conservation Upon Insect Populations. H. B. Owens, L. P. Ditman and W. E. Bickley.

H-58 A Taxonomic Study of the Coccid genus Toumeyella and Some Closely Related Genera. H. S. McConnell.

H-60 Biology and Control of Nut Weevils. W. T. Johnson and W. E. Bickley.

H-61 The Biology and Distribution of *Macropsis* Trimaculata Fitch. W. E. Bickley, Castillo Graham and E. R. Krestensen.

H-64 An Evaluation of the Effectiveness of Commercial Insect Control Practices on Canning Crops. L. P. Ditman.

H-65 Formulation of Sprays for the Home Garden. L. P. Ditman, John Young and Amihud Kramer.

H-66 The Effectiveness of Some Chlorinated Organic Insecticides When Applied to the Soil. L. P. Ditman and W. E. Bickley.

H-67 Factors Influencing Spray Deposits on Some Vegetable Crops. L. P. Ditman, W. T. Whitlaw, W. E. Bickley, George Burkhardt and Amihud Kramer.

H-69 Identification and Control of the Various species of Mites Causing Damage to Apple Orchards. W. E. Bickley, Castillo Graham and E. R. Krestensen.

H-70 Study of the Seasonal History, Parasites and Control of the Unspotted Tentiform Leaf Miner *Callisto* (Parornix) *geminatella* Pack. W. E. Bickley, E. R. Krestensen and Castillo Graham.

H-71-a Investigation of Forage Crop Insects. The Clover Root Curculio. W. G. Phillips, W. E. Bickley and L. P. Ditman.

H-71-b Investigations of Forage Crop Insects. Chemical Control of Insects Attacking Alfalfa. W. E. Bickley, T. E. Bissell, W. Phillips and L. P. Ditman.

H-72 Physiology of Insect Reproduction. J. C. Jones and T. C. Curtin.

H-73-a Bionomics of Maryland Mosquitoes: The Mosquito Fauna in Selected Swamps, Marshes and Impoundments. W. E. Bickley, J. T. Whitlaw, Jr., and S. R. Joseph.

H-73-b Bionomics of Maryland Mosquitoes: Vectors of Filariae Affecting Certain Wild Mammals. W. E. Bickley, W. G. Phillips and B. R. Evans.

H-73-c Bionomics of Maryland Mosquitoes: Feeding Habits of Maryland Mosquitoes in Relation to Eastern Equine Encephalitis. W. E. Bickley, H. D. Newson and R. F. Byrne.

H-74 Biology and Control of Tobacco Insects. F. P. Harrison.

Department of Home Economics

Y-1 Interrelationships in the Metabolism of Different Levels of Protein and Fat in the Diet of College Women. Pela Braucher, H. W. Nilson, Virginia Dawson, Helen Thompson and Genevieve Watkins.

Department of Horticulture

BOQR-83 Engineering, Soil and Plant Aspects of Supplemental Irrigation. (In cooperation with Agronomy and Agricultural Engineering Departments) F. C. Stark, C. W. Reynolds, J. H. Axley, O. E. Street, A. M. Decker, Jr., G. J. Burkhardt, L. F. George, R. E. Wagner and K. E. Felton.

I-74-a Effect of Environmental Factors and Cultural Practices on the Growth and Flowering of Greenhouse Potted Plants. J. B. Shanks and C. B. Link.

I-74-b Effect of Environmental Factors and Cultural Practices on the Growth and Flowering of Greenhouse Cut Flower Crops. C. B. Link and J. B. Shanks.

I-79-h The Relationship of the Mineral Nutrients and of Nutrient Levels to the Growth and Flowering of the Azalea Under Greenhouse Conditions. C. B. Link and J. B. Shanks.

I-79-i The Balance and Intensity of Inorganic Nutrient Elements as they Affect the Growth, Flowering and Quality of *Hydrangea Macrophylla* Thunb. Under Greenhouse Conditions. J. B. Shanks and C. B. Link.

L-73 Adaptation of Fruit Varieties and New Seedlings to Maryland. I. C. Haut, D. H. Britton, A. H. Thompson and F. J. Lawrence.

L-74 Environmental Factors and Cultural Practices in Relation to the Growth and Fruiting Responses of Fruits. A. H. Thompson, L. E. Scott, F. J. Lawrence, B. L. Rogers, S. H. Todd and I. C. Haut.

L-74-b Chemical Thinning of Apples and Peaches. A. H. Thompson, B. L. Rogers and E. A. Stahly.

Q-58-f Development of Objective Grades and Standards and Quality Control Methods for Vegetables. Amihud Kramer, L. E. Scott, Eugenia Sokolov, W. Toldby, W. Anderson, R. C. Wiley, A. P. Sidwell and R. B. Decker.

Q-58-k Development of Specifications for Canned Food Quality. R. C. Wiley and assistants.

Q-58-n Suitability of New Varieties of Horticultural Crops for Canning and Freezing. W. L. Hollis, B. A. Twigg, F. C. Stark, Amihud Kramer, L. E. Scott, R. C. Wiley, W. A. Matthews and H. S. Todd.

Q-58-p Improvement in the Quality of Canned Apple Slices and Sauce Through Studies of Processing Treatments and Chemical Constituents. R. C. Wiley, A. H. Thompson and Amihud Kramer.

Q-58-q Bulk Packaging and Shipping of Raw Vegetables. Amihud Kramer, L. E. Scott and R. C. Wiley.

Q-74 A Study of Regional Adaptation of Certain Vegetable Crops and Varieties in Maryland. W. L. Hollis, F. C. Stark, L. E. Scott, A. A. Duncan, W. A. Matthews and B. A. Twigg.

Q-77 Crop Management Studies with Vegetable Crops. F. C. Stark, W. L. Hollis and R. R. Dedolph.

Q-79-b The Mineral Levels and Interrelationships of Mineral Nutrients in Fruit Plantings in Maryland. L. E. Scott, A. H. Thompson, B. L. Rogers, I. C. Haut, D. R. Heinicke, D. B. Dunlap and E. A Stahly.

Q-79-c Influence of Nutrient Intensity and Balance on the Quality and Physiological Defoliation of Cantaloupes. F. C. Stark and W. A. Matthews.

Q-79-e Influence of Nutrient Intensity and Balance Upon the Yield and Quality of Tomatoes. F. C. Stark, W. A. Matthews and Amihud Kramer.

Q-79-f Mineral Nutrition of the Sweet Potato with Special Reference to Cation Interrelationships. L. E. Scott, A. A. Duncan, F. C. Stark and W. A. Matthews.

Q-79-g Changes in Chemical Composition of the Sweet Potato During Development Storage and Processing as Related to Quality of the Final Product. L. E. Scott, T. L. Senn, W. A. Matthews and F. C. Stark.

Q-79-h Influence of Nutrient Intensity and Balance on the Growth, Yield and Quality of Cauliflower. C. W. Reynolds and F. C. Stark.

Q-81 Cantaloupe Breeding and Selection with Particular Reference to Quality and Resistance to Defoliation. F. C. Stark.

Q-81-b Sweet Potato Breeding and Selection with Particular Reference to Quality and Resistance to Cracking. F. C. Stark, W. A. Matthews and L. E. Scott.

Q-81-c Sweet Corn Breeding with Particular Reference to the Utilization of Cytoplasmic Male Sterility in the Production of F_1 Hybrid Seed Corn. R. J. Snyder and F. C. Stark.

Q-82 Tomato Breeding and Selection with Particular Reference to Greater Resistance to Cracking and to Late Blight. F. C. Stark and W. A. Matthews.

Q-84 Effect of Modified Atmosphere Upon the Storage Behaviour of the Sweet Potato. L. E. Scott and T. L. Senn.

Department of Poultry Husbandry

M-32-l Study of Factors Influencing or Controlling the On-Set of Molt. Mary Juhn, P. C. Harris and C. S. Shaffner.

M-32-m Genetic Differences in Alkaline Phosphatase Concentration of Blood Sera as Related to Differences in Egg Production and Egg Quality. F. H. Wilcox and C. S. Shaffner.

M-33-e Genetic Control of Serum Cholesterol Level. F. H. Wilcox, C. S. Shaffner, P. C. Harris and L. B. Hardy.

M-33-j Fertility Studies with Chickens and Turkeys. C. S. Shaffner, F. H. Wilcox, H. W. Garren, C. E. Weakley, P. Bogdonoff, S. Qureski and E. Clark.

M-34-e Selective Breeding of Medium Sized Turkeys for Improvement of Economic Qualities. C. S. Shaffner and G. D. Quigley.

M-35-g The Requirement of the Growing Chick for Newer Members of the Vitamin B Complex. G. F. Combs, O. D. Keene, W. C. Supplee, G. L. Romoser, John Milligan, Henry Menge, George Arscott, Henry Jones, George Sweet, R. J. Lillie and G. M. Briggs.

M-35-i Amino Acids in Poultry Nutrition. G. F. Combs, G. L. Romoser, W. E. Donaldson, D. F. Middendorf, E. J. Robel, P. F. Twining, G. M. Briggs, J. O. Anderson and P. T. Hsu.

M-35-l Development of Improved Rations and Feeding Methods for Broiler Production. G. F. Combs, G. L. Romoser, J. L. Nicholson, W. E. Donaldson, E. J. Robel, W. C. Supplee, E. C. Quillen and P. F. Twining.

M-35-m Development of Improved Rations and Feeding Methods for Laying Chickens. G. F. Combs, W. C. Supplee, R. D. Creek, N. V. Helbacka and D. L. Blamberg.

M-46 Market Quality of Eggs as Influenced by Antibiotic Treatments. G. L. Romoser and L. E. Elliott.

M-47 Antibiotics, Arsenicals and Related Compounds in Poultry Nutrition. W. C. Supplee, G. L. Romoser, G. F. Combs and Martin Forbes.

M-48 Microbiological Studies Pertaining to Poultry Nutrition. Mary S. Shorb and Pauline Lund.

M-49 Vitamin B_{12} and Chick Nutrition. Mary S. Shorb and Unabelle B. Blackwood.

M-50 The Effect of Rapid Changes in Ambient Temperatures on Egg Production. C. S. Shaffner, F. H. Wilcox, G. D. Quigley and A. C. Campos.

M-51 Development of Improved Objective Methods for Detecting Meat Spots in the Hen's Egg as Related to Quality in Egg Marketing. N. V. Helbacka.

M-53 A Study of the Relationship Between High Ambient Temperature and the Shell Thickness of Market Eggs. N. V. Helbacka and K. N. Hall.

M-54 Studies on Energy Requirements of Poultry and the Energy Content of Poultry Feed Ingredients. E. H. Bossard, G. F. Combs and R. D. Creek.

M-55 The Perception and Preference of Chickens for Different Colors. G. D. Quigley.

M-100 Quality Retention in Poultry Meats as Influenced by Methods of Processing. N. V. Helbacka, K. N. Hall, Mary Juhn and C. S. Shaffner.

Department of Sociology

S-3 Studies in the Population of Maryland. R. K. Hirzel and W. C. Rohrer.

S-3-2 Population Change in Maryland and the Northeast. R. K. Hirzel, M. E. Clippinger, W. C. Rohrer and Gladys Bowles.

S-5 Farmers Attitudes Toward Farming: A Comparative Study of Farm Enterprizes. W. C. Rohrer and Nelson Le Ray.

Department of Veterinary Science

D-52 Investigations of Newcastle Disease in Poultry. Respiratory Disease of Poultry. H. M. DeVolt, P. J. Vasington, A. P. Holst, Frances S. Yancey, S. C. Chang and R. J. Byrne.

D-57 Epizootiology of Equine Encephalitis in Maryland. R. J. Byrne, Frances S. Yancey and Frank Hetrick.

D-58 Infectious Bovine Mastitis. James Kornder.

D-59 An Investigation of "Air-Sac Infection" of Poultry. H. M. DeVolt, R. M. Smibert, M. Forbes, A. R. Gabuten and R. J. Byrne.

D-60 Investigations on Brucellosis of Cattle. Cornelia M. Cotton, Carolyn J. Swann and Claire B. Wolford.

D-61 A Study of Ruminant Metabolism with Emphasis Upon Its Relation to Ketosis. R. B. Johnson.

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Visitors will be welcome at all times and will be given every opportunity to inspect the work of the Agricultural Experiment Station in all its departments.

The bulletins and reports of the Station will be mailed free of charge to all residents of the State who request them.

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